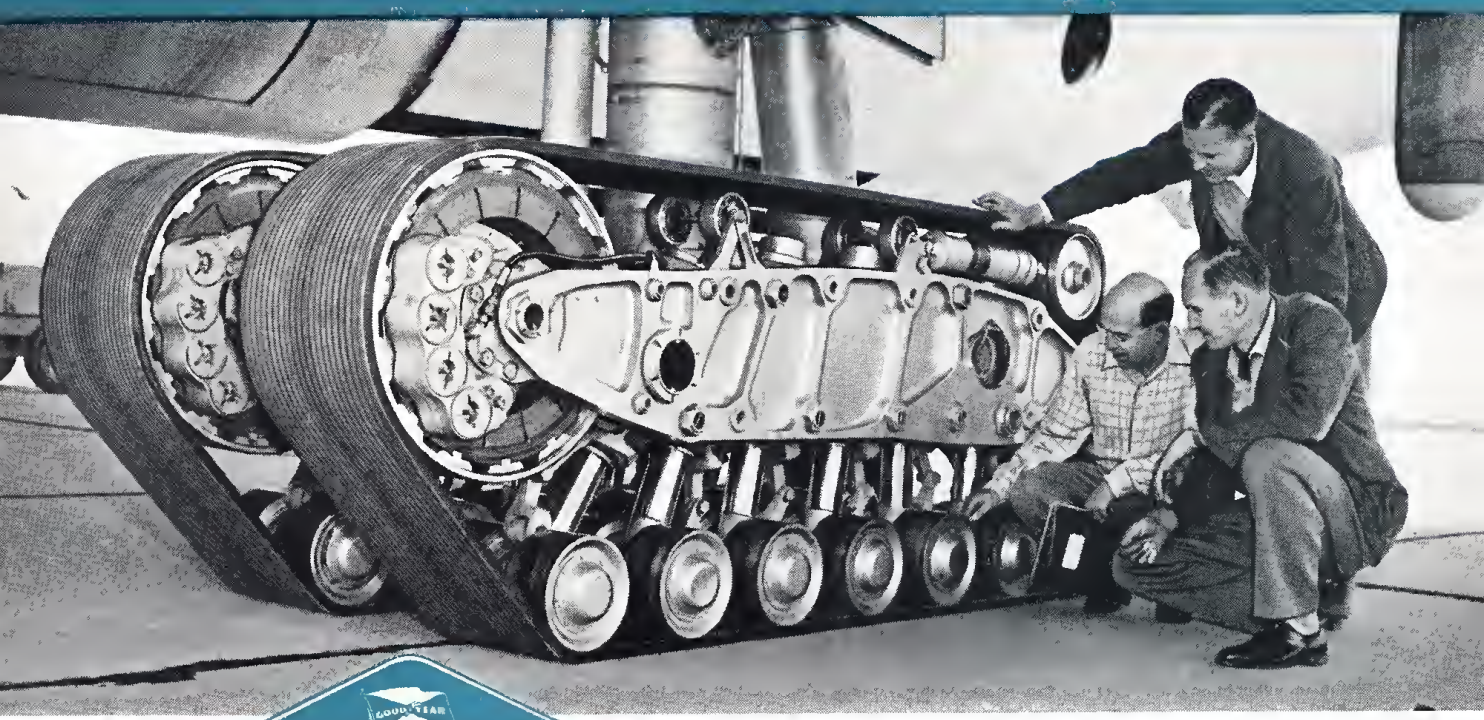
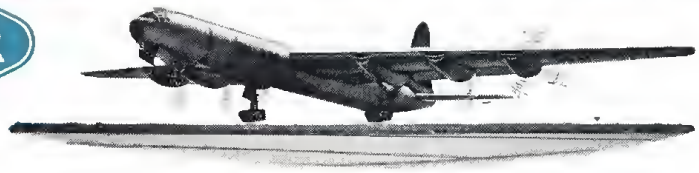
AVIATION WEEK
A McGRAW-HILL PUBLICATION
AUG. 21, 1950



GOODYEAR
AVIATION
PRODUCTS



It makes the B-36 light on its feet

THIS caterpillar-type track gear that permits the giant B-36 to operate from quickly prepared landing strips was developed jointly by Convair and Goodyear engineers. Goodyear experience produced the rugged endless rubber tracks, brakes and brake bogies used in this wide "footprint" gear that safely spreads the B-36's weight.

Goodyear, Aviation Products Division
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MORE AIRCRAFT LAND ON GOODYEAR TIRES, TUBES, WHEELS
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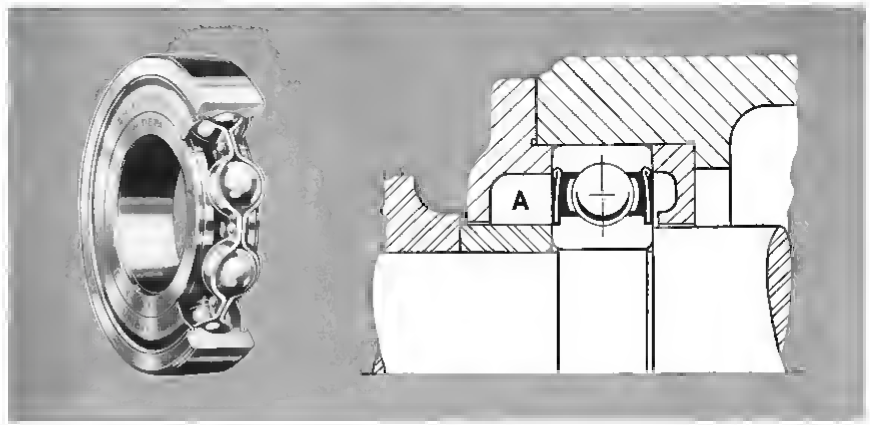

● Most bearing users want bearings that will give them years of dependable service without fussing over lubrication, adjustments, etc—bearings that can be forgotten for long periods and no harm done.

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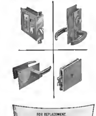

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Aviation Week

Member

Volume 53 **August 21, 1950** **Number 8**

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Sunset on June 30th, 500 miles above a point 400 miles WNW of San Francisco

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Solving the "unsolvable" problems of guided missile development is the task of the most brilliant scientific minds in America today. These experts apply knowledge of practically every branch of science. AiResearch engineers and craftsmen are proud to assist them

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● **If you are concerned with any phase of missile development, you are invited to bring your hard-to-solve problems to AiResearch. Here you will find skilled engineers, the most modern equipment obtainable and—what is most important—the kind of creative thinking that is accustomed to meeting and solving the "unsolvable."**

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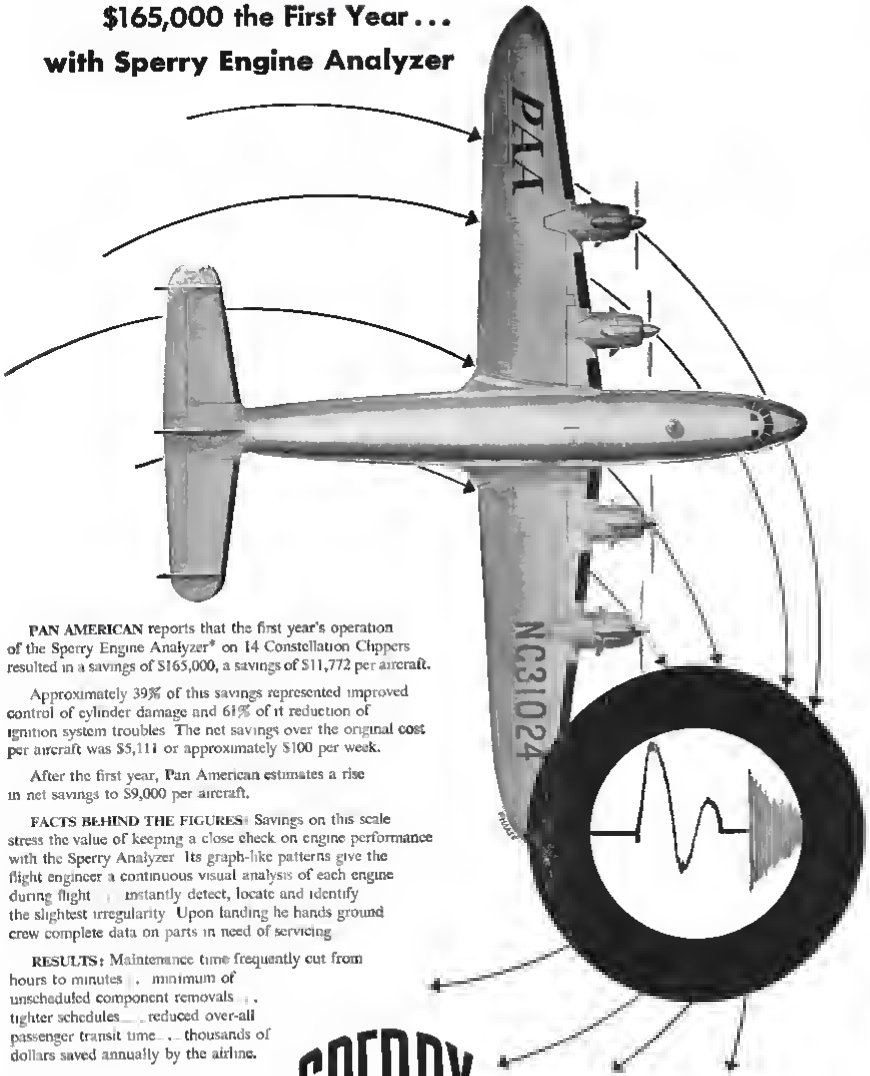
$165,000 the First Year . . .

with Sperry Engine Analyzer



PAN AMERICAN reports that the first year's operation of the Sperry Engine Analyzer* on 14 Constellation Clippers resulted in a savings of $165,000, a savings of $11,772 per aircraft.

Approximately 39% of this savings represented improved control of cylinder damage and 61% of it reduction of ignition system troubles. The net savings over the original cost per aircraft was $5,111 or approximately $100 per week.

After the first year, Pan American estimates a rise in net savings to $9,000 per aircraft.

FACTS BEHIND THE FIGURES: Savings on this scale stress the value of keeping a close check on engine performance with the Sperry Analyzer. Its graph-like patterns give the flight engineer a continuous visual analysis of each engine during flight . . . instantly detect, locate and identify the slightest irregularity. Upon landing he hands ground crew complete data on parts in need of servicing.

RESULTS: Maintenance time frequently cut from hours to minutes . . . minimum of unscheduled component removals . . . tighter schedules . . . reduced over-all passenger transit time . . . thousands of dollars saved annually by the airline.

*Engine Analyzer is manufactured under license from John E. Lindberg, Jr.

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News Picture Highlights . . .

PRONE TO FLY

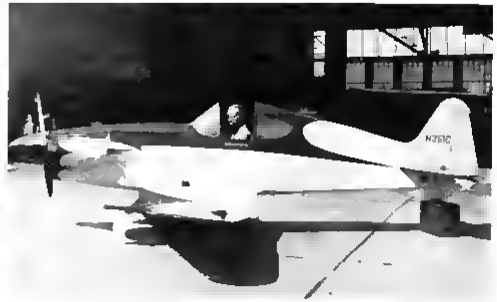
A modified F-80 fitted with a prone-position cockpit has started flight tests under supervision of Stanley Aviation Corp., Buffalo, N. Y. Bed of Nylon netting conforms to body contours

MORE POWER TO THE RAIDER

This Northrop C-125 transport has more powerful 1575 hp. Wright R-1820-101 engines in place of the standard 1200 hp. R-1820-99s. Both models will be evaluated at Eglin Field

SABRE'S AUXILIARY WING TANK

New design underwing fuel tank shown installed under North American F-86 wing is not droppable, carries about 125 gal. Note tail fins with negative dihedral



A NEW MIDGET RACER

This 85 hp. Continental powered racer features an inverted gull wing, permitting direct attachment of landing gear to wings. It was designed by Neal Loving (in cockpit), head of Wayne School of Aeronautics, Detroit

ARGENTINE ALL-WING EXPERIMENT

The Argentine Instituto Aerotecnico is experimenting with this tailless glider developed for the Argentine air force to carry out research on all-wing aircraft. The I.Ae. 34 Clen Antu (Sun Ray) seats two in individual tandem cockpits. Span is 59 ft., overall length 14.43 ft., empty weight 605 lb. Wing is swept about 22 deg. at one-quarter chord. Area is 204 sq. ft.

*10
EXAMPLE PROJECTS

*7
EXTRUDED RACE-WAYS

Problem:

To roll "U" and "E" aluminum extrusions into accurate raceways for revolving cowl sections.

Solution:

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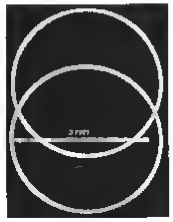
Result:

Perfect rings without distortion or misalignment of material in either horizontal or vertical plane



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NEWTOWN, Bucks County, PENNA.

AVIATION CALENDAR

Aug 25-27—Fourth Annual Air Force Assn national convention, Hotel Statler, Boston

Sept. 5-10—Eleventh flying display and exhibition, Society of British Aircraft Constructors, Farnborough airfield, England

Sept 7—Pratt & Whitney distributor operation and maintenance meeting, Pacific Airmotive Corp, Linden, N J

Sept 9-10—Third annual convention of the California Wing of the Air Force Assn., Arrowhead Springs Hotel and Spa near San Bernardino, Calif.

Sept. 10-14—Instrument Society of America instrument conference and national exhibit, the Coliseum, Houston, Tex.

Sept. 12-14—Conference on ground facilities for air transportation, Massachusetts Institute of Technology, Cambridge, Mass

Sept. 15-22—Fifth national instrument conference and exhibit, Memorial Auditorium, Buffalo, N Y

Sept. 19-21—Joint meeting on navigation and electronics, sponsored by the Institute of Navigation, the Radio Technical Commission for Aeronautics and the Radio Technical Commission for Marine Services, Hotel Statler, N Y C

Sept 25-27—1950 national electronic conference, Edgewater Beach Hotel, Chicago

Sept. 28-30—Aeronautic meeting and aircraft engineering display, Society of Automotive Engineers, Hotel Biltmore, Los Angeles, Calif

Sept 28-30—14th annual convention of International Northwest Aviation Council, Sun Valley, Idaho.

Oct. 12-13—1950 conference on airport management and operations, Max Westheimer Field, North Campus, University of Oakland, Norman, Okla

Oct 16-20—1950 annual general meeting of the International Air Transport Assn, Fairmont Hotel, San Francisco

Oct. 24-25—Third biennial Materials Handling Conference, sponsored by Westinghouse Electric Corp, Hotel Statler, Buffalo, N Y

Oct 25-26—Flight Safety Foundation annual Safety Seminar, Denver, Colo

Nov 29-Dec. 1—Eighth annual meeting of Aviation Distributors and Manufacturers Assn, Ambassador Hotel, Los Angeles

Dec. 16-14th Wright Brothers Lecture, Institute of Aeronautical Sciences, U S Chamber of Commerce Auditorium Washington, D C

Jan 29-Feb 1, 1951—19th annual meeting of the Institute of Aeronautical Sciences, Hotel Astor, N Y

May 30-Sept 9, 1951—World Transportation Fair, Santa Anita Park, Arcadia, Calif

PICTURE CREDITS

7—Wide World, Northrop, Walter X Brennan, Howard Levy; 14—INF 16—McGraw-Hill World News; 16—Flight; 17—Esso Export Corp. 21—David A. Anderton; 25—(top) U. S. Navy, (center) H. G. Martin; 28—McGraw Hill World News; 33—John Streuli, 54—Douglas, 56—Dwight Miller

HERE IS A NEW ANGLE TO LOOK AT . . .

Eight 6 ship Mul-T Buildings from International Steel bring revenue to the Miami Valley Flying Service at South Dayton Airport, Dayton, Ohio.

Since door openings are of the greatest importance in a hangar building, International engineers design doors to meet specific hangar requirements. For example, notice the exclusive Bi-fold Canopy door used on the International Mul-T hangar Here, International eliminates all sticking, freezing, and wind or ice failure common to lightweight sliding doors This same sound engineering thinking is carried through in the design of doors for large shop hangars.

WRITE TODAY FOR COMPLETE INFORMATION

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NEWS DIGEST

DOMESTIC

Hamilton Standard division of United Aircraft Corp has been asked by Navy to increase production of propellers for Navy and USAF aircraft The increase is expected to affect 1500 vendors and subcontractors in 29 states

CAB is circulating for industry comment a proposed regulation to take atmospheric humidity into account in determining performance of new transport planes undergoing type certification tests Sept 1 is the deadline for comment

Knox B Phagan, New York finance manager and accountant, has been named USAF deputy controller. Phagan is 62 and has had extensive Air Force experience He worked during World War II in the eastern regional procurement office and at Wright Field He was a colonel when he left the service in 1946

Carrying 93 persons, a Pan American World Airways Stratocruiser flew from New York International Airport to Frankfurt, Germany, with what was described as the highest passenger load for a scheduled trans-Atlantic flight Army had booked the flight solidly for personnel and their dependents

Piper Aircraft Corp., Lock Haven, Pa., has received an Air Force contract for a substantial number of L-18C two place liaison aircraft Military version of the Piper Super Cub, the L-18C is being manufactured for overseas shipment under terms of MDAP The new order follows an original contract completed by Piper last year to supply the Turkish air force with 105 L-18B aircraft

Boeing Airplane Co's Wichita, Kan., division has set an initial employment goal of 15,000 to meet a tripled production schedule on B-47s The figure is 4000 higher than present employment Plans call for a 48-hour work week on two eight-hour shifts and a third pick-up shift working 6½ hours daily

Glenn L Martin Co., for the second time in less than three weeks, has received Navy orders upping its original contract for Martin P5M-1 anti-sub marine seaplanes

Ten more Constellations, four of them Super Connies, were ordered last week from Lockheed Aircraft Corp by TWA and Eastern Air Lines

Trans World's new $6-million order for six Model 749As will bring its total Constellation fleet to 67 planes, largest standardized four-engine commercial fleet in the world, TWA Chairman Warren Lee Pierson said.

Eastern's purchase of four Super Connies is in addition to the fleet of ten of the 92-passenger planes already on order. Capt Eddie Rickenbacker did not disclose the price in announcing the purchase

FINANCIAL

Air Associates, Inc. reported operating loss of $37,601 for the quarter ended June 30. Net loss stood at $29,010 after $8600 provision for income tax for prior quarters Loss was $15,059 for the nine months ended June 30 Sales for the quarter and nine-month period ended on that date were $1,375,215 and $4,160,127, respectively.

Bell Aircraft Corp and subsidiaries report a $459,476 profit for the six months ended June 30, equivalent of $1.05 per share Sales and income for the period totaled $12,220,120. For the corresponding period last year, Bell reported profit of $133,332 on a six-month income of $5,624,905

Beech Aircraft Corp. has voted a 20-cent quarterly dividend to be paid Aug 22 to stockholders of record at the close of business Aug 8 This makes a total of 60 cents paid during the company's first nine months of its present fiscal year Total sales for the period were $10,988,713, with net income at $351,355.

United Aircraft Corp. reports net income, after taxes, of $6,432,136 for the six months ending June 30 on sales and other income of $132,709,601 Income was equivalent to $2.17 per common share As of June 30, contracts, orders and letters of intent totaled $310 million, compared with $275 million on Mar. 31

INTERNATIONAL

British are planning to send the Armstrong Whitworth Apollo turboprop airliner on a European tour after the SBAC show which ends Sept 10 Some modifications have been incorporated in the craft Addition of a dorsal fin, increase in tailplane span and widening of its supports, increased flap area with flaps under fuselage eliminated The Apollo has completed over 100 hours of flight testing

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The A.R.C. Type 11A

This system is designed to meet basic needs by providing for VHF transmission, LF range reception and rotatable loop navigation

The A.R.C. Type 17

This system introduces two-way VHF equipment It includes a five-tunable VHF receiver and a five-channel, crystal controlled VHF transmitter As many as three of these transmitters may be installed, thus providing up to 15 channels.

The A.R.C. Type 12

This equipment combines the advantages of the Type 11A and the Type 17 systems. It offers two-way VHF communication, together with LF range reception and rotatable loop navigation. Ask about our Type 15B Omni-range equipment and our 10-channel Type F-11 Isolation Amplifier.

All units of these systems are type-certificated by the CAA. For the highest standards of design and manufacture in radio equipment, specify A R C.

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A Good Sign to Fly to...

As the principal airport serving Madrid, Barajas is fully equipped to accommodate international airliners of all types and sizes. Esso Aviation Products and services are regularly relied on here as elsewhere along the airways of the world. Constant research and development on Esso Aviation Products keep pace and even anticipate the constantly changing requirements of modern aviation. The Esso winged oval symbolizes products of uniform, controlled quality backed by more than 40 years of aviation experience.

**At Barajas Airport and throughout Spain, the marketer of Esso Aviation Products is Standard Oil Company of Spain, S.A.*

ESSO EXPORT CORPORATION, AVIATION DEPARTMENT, 25 BROAD STREET, NEW YORK 4, N.Y.

WHO'S WHERE

In the Front Office

J O Cornette has become the vice president finance secretary treasurer, and company director of Pacific Airmotive Corp He held executive positions with Convair and several large eastern corporations prior to his present connection In other top level moves by PAC Bruce Atwater has been made vice president of the company's eastern division with headquarters at Linden, N J; Ford Palmer became assistant to the president

James D Abeles has been appointed vice president general manager of Purolator Products, Inc., N J filtration equipment makers He was previously assistant to the president and has also served as assistant works manager, assistant plant superintendent, quality manager and cost reduction engineer

Glenn G Whitaker was elected a director of the Wm R Whittaker Co., Ltd., in addition to his duties as vice president-field engineering

Changes

Brig Gen William O Senter has been named chief of the Military Air Transport Service's Air Weather Service ; William B Birren has been made manager of Grand Central Aircraft Co's new Tucson plant

Jack S Hakes has been appointed airport manager at Billy Mitchell Field, Milwaukee

▶Among the Manufacturers—J David Wright has been named assistant manager of General Electric's Industry divisions at Schenectady N Y, Frederic M Roberts is GE's new manager of Industrial Engineering divisions, and Leonid A Umansky has become manager of engineering of the Industrial Engineering divisions

John R Griffin has joined du Pont petroleum chemicals division as aviation consultant Capt John Murphy has been appointed head of the recently established Cleveland USAF procurement field office Arthur F Pelster has joined Jack & Heintz Precision Industries as sales engineer

Two changes in Marquardt Aircraft's administrative engineering staff Walter K Deacon has taken over the new position of assistant to the manager of engineering and manufacturing, and Malcolm Harned became project engineer on one of the concern's major missile power plant projects

Herbert E Ryker has been named adviser and special assistant to the vice presidents and general manager of Hughes Aircraft Co Robert H Cooke has been made assistant traffic manager of Lockheed Aircraft ; George E Holback has been appointed supervisor, materials lab of Glenn L Martin Co

Robert Chatley has joined Cessna Aircraft as director of sales promotion and public relations

INDUSTRY OBSERVER

▶Transport potentialities of the Convair XP5-Y1 turboprop Navy flying boat, plus its steadily improving showing in successive test flights, may result in an initial production order for ten planes. The big plane's last test flight went over eight hours, more than doubling any previous flight.

▶Turboprop versions of the two heavy transports in the Air Force program—the Douglas C-124A and the Boeing C-97A—are probable future developments. New Air Force interest in the Pratt & Whitney turboprop T-34 engine (company designation PT-2) indicates it may be headed for these two transport assignments.

▶Plans to convert one of the two McDonnell F-88 experimental jet penetration fighters to turboprop power will retain the plane's present twin Westinghouse J-34 turbojet engines, and add a third powerplant—an Allison T-38—in the nose, with a 10-ft. diameter eight-blade Curtiss propeller. Armor will be stripped from the plane to permit the additional powerplant installation. Project aims to make first flight test of new thin-bladed propeller of transsonic, or possibly supersonic capabilities, in an airframe with design capabilities of Mach 1 or better.

▶The Canadian night fighter CF-100 Canuck last week flew from Toronto to Montreal in 30 min 10 sec for an average speed of 638 mph, setting a new inter-city record.

▶Cornell aeronautical laboratory has developed a small valveless pulsejet engine to power guided missiles and helicopters. It is credited with much improved performance over the older pulsejets similar to the German V-1's powerplant. Reed valves in the V-1 type engines were a source of flow losses and were subject to severe fatigue at high temperatures, thus having a very limited service life. The performance stepup is obtained by modifying the shape of the duct and elimination of the valves.

▶A Piper Cub used in recent stall warning tests, is going out in the CAA regions to demonstrate results of the tests which were conducted by National Research Council for CAA. Plane was equipped with a stall warning indicator, an angle of attack indicator and a radio altimeter.

▶Bristol Brabazon Mark I transport, despite its huge size, was making landing and takeoff runs as short as 1200 to 1400 yd. in recent flight tests at London Airport. Although it was not operating at full gross weight (300,000 lb.), Bristol engineers believe the tests show that it could operate at full gross from virtually any first-class international airport.

▶Use of boundary-layer control devices can reduce the total landing distance for a liaison type airplane from 25 percent to 40 percent below what it would otherwise be, NACA analysts have reported. Calculations used various conditions, including wingspans of 25 to 100 ft. and engine power from 300 to 1200 hp., for the study.

▶An experimental turbine-propeller version of the Boeing B-47 is now in a planning stage. Presumably it is intended to give the USAF some information it once planned to get with a turbine propeller version of the Boeing XB-52 eight-jet experimental bomber, which later became the turbojet version now under construction.

▶The Sperry Zero Readers for British Overseas Airways' Comet and other planes (AVIATION WEEK Aug. 14), probably will be made or assembled in Britain to avoid payment of dollars for the equipment. If it proves practical to produce the Readers in England, it should increase Sperry's chances to sell the instrument to the Royal Air Force, which already has expressed interest. RAF is increasing its fleet of night fighters, for which the Zero Reader apparently is of special value, judging from USAF's orders for the instrument for F-94, F-98 and F-84D fighters.

▶The third SAAB Scandia, twin-engine transport, of an order for six by VASP Aerovias, has left Sweden for delivery to the Brazilian airline. The VASP planes are arranged for 32 passengers and are being put into service between Rio de Janeiro and Sao Paulo, Brazil's heaviest-traveled route.

AVIATION WEEK VOL 53, NO. 8
AUGUST 21, 1950

Controls Being Readied for Civil Flying

Proposal for CAA study being framed by aviation groups.

By Alexander McSurely

U. S. civil aviation is headed for new wartime emergency controls soon.

All signs in Washington—up on Capitol Hill, in the Department of Commerce, in the Department of Defense—point that way. And veteran aviation organization representatives in Washington are getting ready to forestall, by voluntary planning for emergency mobilization, the maximum military restrictions which could be imposed.

Here are some of the unmistakable signposts:

• **A bill directing** the Secretary of Commerce to establish new restricted zones for aircraft at his discretion, whenever the President determines this is required in the interest of national security, is apparently headed for prompt passage in Congress. Senate Interstate and Foreign Commerce Committee has already reported it favorably. Similar committee action is forecast in the House.

• **A bill authorizing** an emergency transfer of CAA federal airways personnel to a military Civil Aeronautics Corps, under the Air Force, with the Administrator transferred as Chief of Corps, is now being reviewed by the Bureau of the Budget, and is expected to be submitted in revised form soon for congressional action.

• **CAA's Aviation Development Advisory Committee**, charged with producing a plan to utilize non-airline civil aviation in a national emergency, was to begin meeting in Washington today to form its recommendations.

• **Voluntary blueprint** for efficient emergency use of civil aviation resources was proposed last week by the Emergency Aviation Council formed by 12 aviation organizations.

The conferees represented in the Council were American Association of Airport Executives, Aircraft Industries Assn., Aviation Distributors and Manufacturers Assn., Airport Operators Council, Aircraft Owners and Pilots Assn., Aeronautical Training Society, Corporation Aircraft Owners Assn., National Aeronautic Assn., National Air Council, National Association of State Aviation Officials, National Aviation Trades Assn., and National Flying Farmers Assn.

The only two major aviation business organizations not participating in the conference were Air Transport Assn. and Air Line Pilots Assn. But spokesmen for both these organizations told AVIATION WEEK they too were vitally interested in certain aspects of the civilian planning such as control of airports, security arrangements, etc., and will make specific recommendations of their own.

In advance of the Advisory Committee's report, the tentative mobilization plan of the Emergency Aviation Council offers probably the best guide now available to what civil aviation wants to do and can do under wartime controls if it is not tied hand-and-foot by military restrictions.

"If civil aviation is permitted to continue under reasonable rules it will carry its own overhead without aid from the taxpayers except for services actually rendered. It will maintain the existing airport system, civil aircraft and maintenance facilities and remain on a ready basis to supplement existing transportation and perform many war-connected services," the report states.

The plan calls for a national voluntary mobilization system of civil aviation with regional and national coordination, planned to meet "the worst type of emergency such as the atomic bombing of several cities."

It is pointed out that in such emergency, the civilian lightplane fleet might be the only mobile force available for civilian aid.

While CAA's advisory group is compiling an up-to-date inventory of civil aviation's resources, an approximate report by the EAC, in its plan, shows the following round figures:

Municipal and commercial airports	5000
Private and other civil fields	1500
Civil aircraft	90,000
Pilots with private rating and more	500,000

These are compared with the status at the beginning of World War II when there were:

Civil airports	2200
Civil aircraft	25,000
Pilots	100,000

▶ **No CAP Control**—The civil groups' proposal is directly opposed to any plan for the Civil Air Patrol to assume control of all civil aviation.

"Under no circumstances should CAP regulations or controls apply to any person or aircraft not a member of CAP nor should CAP activities in any manner restrict or compete with commercial use of civil aircraft," it sets forth.

▶ **Mission Limits**—CAP mission should be limited, in the views of the aviation industry groups, to: Semi-military services such as submarine patrol, tow target flights, courier service between military commands, and assistance in search and rescue, evacuation and recruiting.

The plan recommends establishment of controls for airports, aircraft, personnel and flight operations.

▶ **Airport Controls**—Each airport should be identified as a control airport, or an auxiliary airport within the mobilization plan.

Federal and state aviation agencies should establish the availability of each airport for participation in the plan. Each airport should have security personnel with local police and civilian defense personnel used where possible. Uniform regulations and controls should be established for operations, as far as possible.

▶ **Plane Registrations**—All civilian aircraft should be registered with a record of type, CAA number, base, owner's name, address, occupation, plane capacity and use, and other essential information. Registration should be carried in the plane at all times.

Airmen and ground personnel should be identified with registration cards showing picture description and fingerprints, but airport operators should be permitted to clear their ground personnel with local police for temporary employment pending completion of identification registration.

▶ **Flight Clearance**—The conference plan would authorize control airports, picked by state aviation agencies, to issue, endorse and file flight dispatch clearances only when such detailed control is necessary to defense. Other duties will include advising airmen of restricted areas and other security requirements, maintaining records of aircraft owners and aircraft. Auxiliary airports would be authorized for limited operation providing that all flights other than local area flights were cleared by the nearest control airport, and providing suitable arrangements for security of planes was provided.

A conference timetable for establishing the emergency plan shows the following priority:

• **Complete inventory** of national civil air resources.

• **Identification system** for airmen, ground crews and aviation radio operators. Devise special identification for those who lack satisfactory cards.

• **Plan for maintaining supply** of critical aircraft parts and materials.

• **Form state aviation councils** to advise on plans.

• **Select control airports** tentatively.

• **Issue unclassified**, tentative security rules for study and comment.

• **Conduct simulated operations** to pretest such rules.

• **Encourage training** and practice, such as navigation, meteorology, cross-country flying, and simulated disaster and search missions.

• **Encourage physical checkups** to keep pilot licenses valid.

• **Arrange police authority** for appropriate personnel, if later necessary, to carry arms and make arrests.

• **Encourage operators** to stockpile fuel, parts and other necessary items not now in short supply.

Other recommendations call for wide circulation of initial planning, and urge that detailed planning for national, regional, state and local mobilization be completed at the earliest possible date—but that actual controls be imposed only at such times and places as may be required.

What Civilian Aviation Can Do

What can civilian aviation do under national war emergency conditions? Plenty, says the Emergency Aviation Council, formed recently by 12 leading civil aviation groups. Here are the uses for civilian planes suggested by EAC in its mobilization outline to CAA:

• **Disaster**—Flying in medical and other urgent personnel and supplies; evacuation, patrol, traffic control and communications.

• **Civil defense**—Anti-sabotage patrol, and mock air raids.

• **Military missions**—Coastal patrol, border patrol, search and rescue, Air Force courier, radar and spotter tests, target towing and tracking.

• **Agricultural uses**—Crop dusting and spraying, seeding, supply and supervision of large farms and ranches.

• **Industrial and business uses**—Flying key personnel, delivery of critical parts and materials, patrolling pipelines, power lines, forest fire patrol.

• **Training and practice**—Pilot, mechanic and technician training for armed services, civilian flight training, practicing emergency operations.

• **Recruiting and youth activity**—Pretraining and screening of aviation cadets, providing orientation flights for trainees and prospective recruits.

• **Business transportation**—Air taxi serving off-airline cities, charter flights, cargo delivery, ambulance flights.

• **Other uses**—Civilian search and rescue, relief flights in natural disasters such as floods, fires, storms, snow, etc., wild-life conservation, fish spotting and aerial photography and mapping.

Aviation Projects Listed for 1951

An allocation of $30.5 million is earmarked in the first installment of military public works spending for fiscal 1951 to complete construction of the radar "fence" to shield the U. S. from foreign air attacks.

Four other major aviation projects with allocations scheduled include:

• **Arnold Engineering Development Center**, $15 million to complete the first phase $100 million program.

• **Limestone AFB, Maine**, $10,245,216 for a "classified" project concerned with the further development of the bomber base, closed under the Johnson economy program.

• **Eglin AFB, Fla.**, $7,550,000 for armament evaluation center.

• **Long-range proving ground, Cocoa, Fla.**, $6,257,000 for further development under an ultimate $75-million development plan.

Funds totaling $62,928,000 for the Navy and $59,468,912 for the Air Force are included in the omnibus 1951 fiscal year government appropriation bill, now before a joint conference committee on Capitol Hill. In addition, as a result of the Korean war, the President has asked for $85,978,000 for Naval and $169,700,000 for USAF public works for the 1951 fiscal year.

Other aviation projects planned for this year are:

• Aeronautical chart facility (USAF) at St. Louis, $1,500,000 for relocation.

• Barksdale, La., AFB, $900,000, for fuel location.

• Campbell Ky. AFB, $80,000 for control tower and security fence.

• Great Falls, Mont. AFB, $2,320,000, for airfield improvements.

• Hood, Tex. AFB, $1,002,197 for expansion.

• Langley, Va., AFB, $330,000, for fuel facilities.

PACK PLANE MAKES MAIDEN FLIGHT

Fairchild's new XC-120 cargo plane, with detachable fuselage, shows its unusual profile for the camera during its first hop on August 11 at Hagerstown, Md. The big (64,000 lb. gross weight) USAF transport offers great prospects for more efficient military and commercial air freight handling. The detachable pod has a 2700-cu. ft. capacity. Power is supplied by two Pratt & Whitney R-4360-20s developing 3250 hp. each, turning Hamilton Standard four-bladed square-tipped props.

- McChord, Wash., AFB, $352,377
- McGuire, N. J., AFB, $250,000.
- Moses Lake, Wash., AFB, $3,287,000
- Muroc, Calif., AFB, $3,800,000
- Selfridge, Mich., AFB, $315,336, for run way extensions.
- Spokane, Wash., AFB, $4,570,000
- Tacoma, Wash., AFB, $200,000
- Wright-Patterson, Ohio, AFB, $782,000, for high powered electric whirling.
- Inyokern, Calif., Naval Ordnance Test Station, $1,000,000 for planning and design on aerodynamics ballistic track range.
- Jacksonville, Fla., Naval Air Station, $1,900,000, for aircraft carrier berthing-turning basin.
- Johnsville, Pa., Naval Air Development Station, $163,500 for runway approach zone and test facilities.
- Miramar, Calif., NAS, $2,230,000 for hangar and gas storage facilities.
- Norfolk, Va., NAS, $485,000 for test cells for turbine engines.
- Quonset Point, R. I., NAS, $300,000, for completion of two engine test cells.
- Trenton, N. J., Naval Aeronautical Turbine Laboratory, $4,750,000 for laboratory and facilities.
- Runway extensions for jet operations, $3,620,000, at Naval stations at Oceana, Va., Miramar, Calif., and Norfolk, Va.
- Whidbey Island, Wash., NAS, $35,800, for land for target range.

In addition, $11,352,300 is provided the Army for development at the Ladd AFB, Alaska.

GIs IN JAPAN loading boxes of rations into an air transport plane that will carry them to U. S. troops in South Korea.

Korea Points Up Freighter Needs

Aircraft speed isn't as important as cargo-handling qualities; low fuselage, large enough doors wanted.

By A. W. Jessup

(McGraw-Hill World News)

An Airbase in Japan—The airlift for the United Nations force in Korea is a small show. Nothing about it compares with the Berlin Airlift.

This little war is being fought where it's possible to move the bulk of supplies by ship, tram and truck. Airlift is reserved for transporting emergency supplies and specialized personnel. Occasionally, it makes life easier for airmen in Korea by carrying over comfort items, like a recent C-47 load of lavatory crockery for advanced Air Force headquarters.

▶**Can Carry More**—The Troop Carrier Wing, Fifth Air Force, handles all the airlift from Japanese supply bases to Korea. It hasn't come close to its maximum load factor. There just hasn't been enough emergency cargo to keep its 25 C-54s, 32 C-47s and six C-46s busy. C-54s can't land on South Korean airstrips, so are used for transporting supplies from the major supply bases in central Japan to an airbase in Kyushu just across the Strait from Korea. There C-47s pick up the loads for the final haul to points in South Korea. C-46s are used only for bulky loads impossible to load onto a C-47.

The Wing has a commitment to move 150 tons per day for the Army and Air Force. It could carry 200 tons with ease. During the first week of August, the average was just over 100 tons per day for the advanced airlift into Korea, and only 90 tons from the central supply points to southern Japan.

Small though this lift has been, it has revealed some specific requirements for future combat air supply operations.

▶**C-47 Replacement Wanted**—Troop Carrier officers want an aircraft to replace the C-47. Still the workhorse and still doing a good job, it isn't the final answer for close support. They want a new aircraft that can lift 10,000 lb. into rough airstrips shorter than 3000 ft. A 350- to 400-mi. range will be adequate.

Speed isn't important. In their opinion, a 100-mph. aircraft will be as good as or better than something faster. In modern air war, the defensive characteristics of a 250-mph. airplane won't be any better than a slower ship. (For the commercial cargo view on speed, see page 54.)

Into the new aircraft must go design for ease of handling cargo. The C-119—four are now here—has fine cargo handling characteristics. But like the C-54 it can't operate into the marginal air fields of South Korea.

The transocean phase of the airlift is being handled by MATS, part with MATS aircraft and part with contract flights from the civil airlines. This averages about 75 four-engine transport flights daily with C-54s (DC-4s), DC-6s and C-97s. C-54s average about 9500 lb. per flight. DC-4 airfreighters carry more, between 11,000 and 12,000 lb.

▶**Concentrated Loads**—Except for the airfreighters, most of the civil airline planes are not too well suited for transporting military cargo. Floor construction for the most part is light and unable to take heavy concentrated loads such as aircraft engines. Commercial carriers aren't really in the freight business normally, but are in light express.

Incoming cargoes from the United States include personnel and classified equipment. Weight ratio is about even. Cargoes include specialized equipment and a large amount of new type rockets. The latter will begin to drop off as cargo when the shipping pipeline of supplies is filled from the U. S. Outgoing payload includes medical evacuation, personnel (mostly dependents of casualties), and mail.

Cargo handlers for MATS complain about the failure to design good cargo handling features into the new aircraft. For one thing cargo compartments are too high off the ground. Each type of aircraft has a different compartment floor height. Someday the aircraft industry must standardize, the way railroads standardize their freight cars.

▶**C-97 Fuselage Too High**—Increasing size of the propellers has raised the wing height and raised the fuselage. Jet transports and airliners should be designed with fuselage closer to the ground to simplify both passenger and freight handling problems. But except for the Packets, there apparently has been no consideration given to designing conventional aircraft with low-slung fuselages. The C-97 is a good example. There is nothing simple about handling cargo on it, even with the monorail.

Cargo compartment floor height is very high. There is only one major opening, through the rear underbelly. And that isn't convenient. The flaps don't open out far enough for a heavy truck to be spotted easily under the end of the cargo floor. Even a fork lift has to be maneuvered into position very carefully.

Heavy loads have to be slung for lift on the monorail. Even when slung tight, aircraft engines are difficult to move with the monorail because clearance is limited between rail and floor.

Cargo handlers want transport aircraft built as close to the ground as possible. Cargo doors must be big. Large cargo aircraft with long compartments should have at least two large entries. Monorails are a help, but there must be enough clearance so that slung loads can be moved easily.

Too much stress has been laid in the past on designing aircraft to carry heavy tanks and guns. War in Korea indicates that our aircraft needs are much simpler and more direct. Ammunition, personnel, food, signal equipment and light weapons are the priority items. Even if tanks were needed, there aren't any airstrips in South Korea capable of handling tank-carrying aircraft. If the U. S. is faced with more war in this century, the chances are those will be little wars too. And the other Koreas won't have any Templehofs either.

KLM Zero Reader

KLM Royal Dutch Airlines announces that it is the first commercial airline to receive CAA operational approval to use the Sperry Zero Reader.

Installation and functional flight tests on Constellation aircraft were conducted at the Lockheed Air Terminal through cooperation of Lockheed Aircraft Service and the Sperry Corp.

These tests, in addition to others being conducted with Sperry at Mac Arthur Field, Long Island, are under the supervision of Captain George Maloom, KLM's general flight superintendent.

SETTING UP THE NEXT PLAY

Brig. Gen. Edward J. Timberlake, Jr., (left) deputy commander of the 5th AF, graphically explains to a pair of grim-visaged AF officers at an advanced fighter base in South Korea a tactic designed to make some North Korean invaders unhappy.

Support Planes

Tactical deficiencies in Korea put pressure on AF, Navy planners.

Deficiencies of tactical troop support jet planes over Korea are putting heavy pressure on Air Force and Navy planners. Limited range and high fuel consumption are the two main problems being tackled.

Until the long-term answer is found, Washington thinking is considering the following temporary solutions:

- **Revived production** of the two best fighters of World War II, the Chance Vought F4U Corsair and the Grumman F8F Bearcat, is being considered by some Navy men.
- **New fighter-bomber** capable of meeting Army requirements for close ground support work has been asked of industry by USAF.
- **USAF has loaded down** the Republic F-84F, described as its best available fighter-bomber for a tactical support role, with four external fuel tanks plus its rocket armament and internal fuel supply in an effort to give it more time over the target.
- **Use of the North American B-45**, which, of all the jet planes on hand in quantity, seems most nearly to fill the troop support requirements. But only a limited number of these is in being. A total of 139 was ordered, but the plane is now out of production.
- **Put the mothballed fighters** and bombers of World War II—longer-ranged, though slower than the jets—back into service. This is being done, with contracts already let to restore the Douglas B-26 Invader light bomber and three fighters (North American P-51, the F4U and the F8F) to active service, alongside some of the same types which have still remained in squadrons.

▶**Not Too Fast**—The Air Force has knocked down rumors that the jet fighters were too fast for close ground support. The jet fighter has made a remarkable showing insofar as accuracy is concerned. In air battle, the F-80 and the Navy's F9F have thus far made the air untenable for anything the North Koreans have put up.

Primary factor limiting the jets in battle is their range. Airworthiness of the F-80 after battle damage has been clearly demonstrated (AVIATION WEEK Aug. 7).

▶**New Role**—The jet fighter is being forced into a role for which it was never designed—low level strafing 300-500 mi. away from base. Result of this is a high fuel utilization factor. Air Force is trying to offset this situation by building strips near front lines. But building adequately, in view of the pressure of

the battle line, has been almost impossible.

The Korean incident has upset the timetables of the Joint Chiefs. The changeover to jet power is just now underway in volume. Although flight performance and maintenance are satisfactory, the greedy fuel utilization has been a knotty problem and apparently is not solvable in the near future.

Joint Chiefs of Staff timetables had called for an effective firstline force by the end of 1952. Far better showing in ranges of jet and turboprop aircraft was scheduled for then, based on present developments and test levels. The Korean war canceled that schedule and has made it mandatory that USAF and Navy get their war-proven long-range fighters and bombers back to frontline service.

▶**Proposed Fighter-Bomber**—The design specifications for the proposed USAF turboprop fighter-bomber call for a plane capable of a 500 mph speed, 45,000 ft ceiling, 2500-mi range, with heavy machine gun, rocket and bomb armament.

Although primarily interested in a new design, USAF has indicated willingness to examine conversion of existing fighters which might fill the bill more rapidly. Most likely prospect would be Douglas Aircraft's turboprop A2D, which, with sweptback wings, might meet the requirement.

▶**MDAP Commitments**—Making the troop support task even more complex is the fact that both USAF and Navy have already committed excessive numbers of their wartime reserve of piston fighters to North Atlantic Treaty nations under terms of the Mutual Defense Assistance Program.

Air Force has hotly denied for years that it pays only lip service to the needs of the Army in tactical support of ground troops. It insists that all possible aid has been given to this phase of air war, despite its primary mission of carrying the war to the enemy via long-range strategic bombers.

▶**TAC Gets First Planes**—Swarmer, conducted jointly by USAF and Army early this summer, weakened this premise. As a result Air Force has set up a Tactical Air Force, which this year for the first time gave the Tactical Air Command aircraft of its own. Swarmer also proved to USAF strategists that establishing and supplying an airhead entirely by air using present assault and heavy cargo transports would be no easy problem, even with complete air supremacy.

In the assault transport field, Air Force equipment is negligible. The only plane in production, that even approaches USAF-Army requirements for an assault transport, is the Fairchild C-82 (and its later counterpart the C-119). It was not designed for assault transport, nor is that its mission.

Another plane designed originally as an assault aircraft is the Northrop C-125 Raider, now in production but relegated to a role of Arctic rescue service.

The Chase XC-123 assault transport, scheduled for evaluation tests beginning Sept. 18 at Eglin AFB, Fla., in competition with the C-125 and the stripped-down C-119, meets Army and USAF assault requirements generally, but is not as yet in production.

Boston Air Fair Will Show X-1

The first public showing of USAF's supersonic research plane, the Bell X-1 (AVIATION WEEK Dec. 22, 1947) will be chief drawing card of Air Force Assn.'s 4th annual convention, Aug. 25, in Boston.

The plane is being flown to the Boston Air Fair slung under a Boeing B-50, and will be displayed for the first time to the public before it is turned over to the Smithsonian Institution for the National Air Museum in Washington, D. C.

Officials at USAF's Air Materiel Command, according to the Air Force Assn., have promised more exhibits to the Boston Air Fair than have ever been shown at a single aviation event. This came as somewhat of a surprise in view of Defense Secretary Johnson's recent edict forbidding military participation in public demonstrations, which virtually forced the closing of the National Air Races at Cleveland.

Among other USAF exhibits at the Air Fair will be the North American B-45 Tornado light jet bomber, North American F-86 fighter, a radio-controlled target plane, a remote-controlled B-29 gun turret, miscellaneous engine, radar and electronic devices.

The Royal Canadian Air Force will participate with a five-man team flying Vampire twin-jet fighters in demonstrations of precision flight tactics. On static exhibit will be the Canadian A. V. Roe CF-100 jet fighter, making its second U. S. appearance.

The Air National Guard will fly Republic F-47 Thunderbolts and F-84 Thunderjets. This will be followed by a mock ack-ack barrage by an anti-aircraft unit.

Not to be outdone by military participants, 50 members of the Ninety-Nines, an association of women pilots, will compete in the Powder Puff and Beau Derby, a lightplane race from Columbus, Ohio, to Logan, Airport Boston. A wartime Wasp ferry pilot, Miss Caro Bayley, Springfield, O., will appear in a lightplane acrobatics exhibition.

The AFA convention is expected to be attended by approximately 1500 delegates from 200 local units. Headquarters will be located at Boston's Statler Hotel.

Reverse Props

Eastern Air Lines reveals that it is installing reversible pitch propellers on one Model 749 Constellation for test purposes. EAL's Martin 4-0-4s will also carry this installation.

HAWKER JET SHOWS ITS STUFF

Hawker Aircraft's new P.1081 single-seat jet fighter banks steeply to show off its swept wings and tail, undercarriage location and single tail-exhaust pipe for the Rolls-Royce Nene turbojet, rated at about 5000-lb. thrust. Australia is expected to put this model in production in place of the earlier version having split pipes at the wing trailing edges. The P.1081's span is 31 ft. 6 in., length is 37 ft. 4 in.

MODEL of typical installation. Bulk storage is at left, multiple hydrants under ramp.

COMPACT servicer in use. Fuel from flush hydrant is delivered through two hoses.

Lima Getting Hydrant Fuel System

Esso Export's gravity-feed fueling being installed at Peruvian airport; opinion divided on advantages.

Esso Export Corp., leading exponent of hydrant fueling systems for airports, has completed engineering preparations for installation of such a system at Limatambo Airport, Lima, Peru.

The Lima work underlines a growing interest in this type of system. Major installations at other international airports are being negotiated, Esso Export spokesmen say, and "considerable interest" in the hydrant system has been expressed by the Air Force. A Pan American World Airways fuel superintendent told AVIATION WEEK he is recommending to his company that it favor such an installation at the Houston, Tex., Municipal Airport.

▶**Lima Work Started**—A. D. Lewis, Engineering and Field Service division head who recently returned from Lima, said installation of the gravity feed tender hydrant system there already has started. Provision for it was made when the airport was built, but final decision to go ahead with it is less than a month old.

The airport has been completed. The new system is expected to be in operation by the end of this year. In the meantime, fuel trucks are being used.

Esso Export engineers say this is only the second time complete plans have been made for installation of the hydrant system when an airport was newly constructed or rebuilt. Others have gone in at existing airports.

Large installations are functioning at Gander, N. F., Keflavik, Iceland; Morsant, New Orleans, and Tocumen, Panama, the other field where the system was built with the airport.

Of the two basic types of hydrant systems—gravity and pressure feed—Esso Export experts favor the former. They feel that the gravity method, in which "servicer" units draw fuel from an underramp hydrant and pump it into a plane's tanks, is simpler and less expensive than the pressure system, where the need for pumps involves more moving parts and greater maintenance.

▶**Time Not Ripe?**—Not all companies agree with Esso that the time is ripe for general use of the hydrant system, whether gravity or pressure. Shell Oil Co., for instance, told AVIATION WEEK that, while the fixed system of fueling has many advantages, it requires that ramp operations be stabilized, and "since at most terminal airports this is not the case, Shell doubts that the installation of fixed systems is justified at this time. They are expensive to install, and relocation requires considerable expenditure."

Esso Export maintains that with the hydrant system, although aircraft are required to come to a fuel area (common practice today), planes can be spotted within 50-75 ft. of a hydrant station for refueling. And several can be serviced from one multiple hydrant.

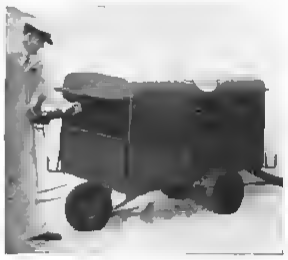
▶**Gravity System**—In the gravity feed system preferred by Esso, bulk storage tanks, usually in a remote part of the field are raised to give static fuel pressure of approximately 5 psi. Underground pipes carry the fuel to the hydrants—one pipe and hydrant system for each grade of fuel.

The self-propelled "servicer" pumping units are used at larger airports to draw fuel from the under-ramp hydrant and pump it into the plane's tanks. Each servicer is equipped with 50 ft. of 3-in. suction line and two 100-ft. discharge hoses with nozzles adaptable for over- or under-wing fueling.

Discharge rate can be as high as 200 gpm. per hose. (Esso Export considers this adequate for the foreseeable future.) Five-micron filters and metering equipment are incorporated in each of the servicers, which are built to the company's specifications by Couse Laboratories at Newark, N. J.

Where high-speed fueling is not essential, smaller hand-drawn hydrant carts with lower discharge capacities, up to 100 gpm. through one hose, are available.

▶**Pressure System**—The pressure feed system, almost identical in layout to the gravity method, can be used, Esso Ex-



HYDRANT cart can pump 100 gpm.

Pressure Feeders

Domestic airports are getting their share of the new attention being turned to the hydrant method of aircraft fueling.

A 12-hydrant pressure feed system for 91 and 100 octane fuel was recently put into limited service in the hangar area at the Philadelphia International Airport, according to Esso Standard Oil Co. The system is available for Wings, Inc., Piasecki Helicopter and the USAF.

Removable concrete blocks covering sand-filled trenches permit rapid and inexpensive installation of additional piping from bulk storage to hydrants when expansion is required.

Within two years Esso Standard expects to install a separate hydrant system in front of the proposed terminal building of the same airport to service scheduled airline departures. Also in view is a third system for the existing cargo and freight areas. Airports at Houston and Fort Worth, Tex., will soon have installations.

The company is considering an installation at Friendship Airport, Baltimore, Md., but is awaiting data from the airlines serving the field to determine whether the fuel demands will be large enough to warrant it.

Esso says airports where this fueling system has been in operation are Teterboro and Atlantic City, N. J., Wheeling, W. Va., and Williamsport, Pa.

port says, where field topography prohibits gravity feed. The pressure method features submerged bulk storage tanks with pumps nearby to force fuel into a plane through a servicer or hydrant cart which filters and measures it but does not pump it.

Additional pumps automatically keep line pressures constant when two or more hydrants are drawn from simultaneously.

In addition to the flexibility which permits several planes to be serviced from one multiple hydrant location, Esso Export sees these advantages for either type of hydrant system:

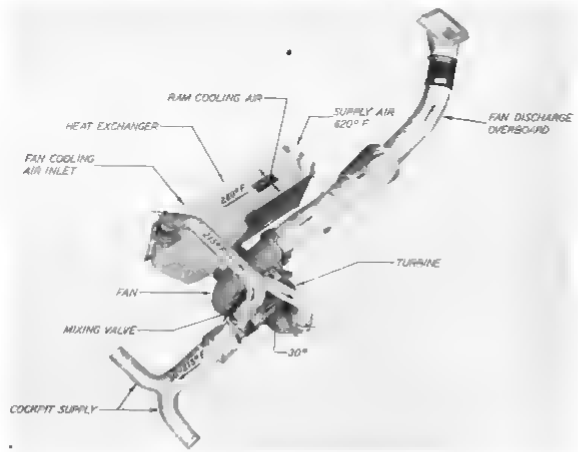
• **Hazard reduction.** Transportation of large quantities (up to 4300 gal.) of high octane fuel on congested ramps is eliminated. There is less chance for collision between tank trucks and parked aircraft. The small and maneuverable servicers are low enough to pass under wings and fuselage of most modern tricycle-gear planes.

• **Limitless throughput.** Unlimited quantities of fuel can be dispensed by the hydrant system. Modern aircraft are thirsty, with fuel capacities exceeding those of the trucks which service them. So two trucks are now needed and time is lost while they return to bulk storage tanks for new loads.

• **Low costs.** Esso Exports says the initial cost of installing a hydrant system during construction of an airport is not unreasonably high. This, coupled with the low maintenance cost of pipe lines and servicers, the company contends, makes costs of such an installation comparable to the conventional fueling truck setup if amortized over 20 years.

Shell Oil, on the other hand, points to trucks as having the flexibility needed for present-day operations. This company recently put in service 4200-gal. trucks which can service two- and four-engine planes at rates up to 400 gpm. from two hoses. Of the two-axle rather than the trailer type, they can be used in pairs. Shell notes that trailer-trucks can hold as much as 5000 gal., but adds that they require highly skilled operators and are difficult to handle.

Esso Export says supplemental truck service always is available at airports where the hydrant system is in use.



Unit Air-Cools Fighter Cabins

Full-scale production deliveries of aircraft cabin air conditioning units, new development of Hamilton Standard for the North American F-95A jet fighter, are scheduled for later this year, the company announces.

The 20-lb. unit delivers a 120-mph. hurricane to the fighter's cockpit, changing the 60 cu. ft. of air every 15 seconds, the maker says.

The pilot obtains any desired cockpit temperature by controlling a thermostat which operates a mixing valve blending air bled from the engine and reduced to 215 deg. F. with air having passed through the expansion turbine and emerging at 30 deg. F.

The manufacturer pointed out that cooling high-speed aircraft cockpits is essential since heat generated by skin friction with the atmosphere, electrical equipment in the cockpit and solar radiation have boosted inside temperatures to as high as 190 degrees F.

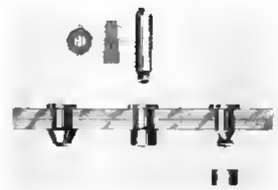
A special lubricating system for the 60,000-rpm., 3-in. turbine wheel, which is the heart of the unit, has enabled one production model to operate over 1000 hr. without maintenance of any kind, the firm states, while five other units are approaching the same figure.

Eric Martin, Ham Standard general manager, says that development of the air conditioning unit has paralleled his company's intensive work of recent years on high speed propellers and turboprop mechanisms. From a production standpoint, he continued, the units will utilize the basic machine tools and manufacturing skill available at Hamilton Standard without heavy investments in tooling.

Ignition Analyzers

Bendix Scintilla, Sidney, N. Y., reveals that the Navy is installing its ignition analyzer in 19 Martin P4M1s. The new Bendix contract is estimated at $60,000.

NEW AVIATION PRODUCTS



High Heat Rivet

The demand for mechanical high temperature performance of certain parts used in jet aircraft and guided missiles has brought about development of a new addition to the Hi-Shear Rivet Tool Co. line.

Hi-Shear now is producing a rivet assembly in which both the collar and pin are made of steel (bottom). Formerly, only the pin was of steel, while the collar was aluminum alloy. The collar in the new rivet assembly is made of carbon steel, the pin of high tensile steel alloy.

The maker indicates the steel collar won't prevent any production problems. The same riveting tools can be used and assembly speed reportedly is the same as when using aluminum-collar rivets.

Another Hi-Shear addition is a dowel pin (top). This part is seemed by a collar at both ends and is designed for fastening where curved or sloped surfaces are encountered. The company says it is lighter, stronger and easier to install than a taper pin and removes the need of spot facing in skimming.

These dowel pins are manufactured to very close tolerance, ±.000125 in., and are available in various sizes and lengths. Address: 1559 Sepulveda Blvd., Hermosa Beach, Calif.

Instrument Oil

The joint research efforts of a well-known instrument company and a major oil company have resulted in an important development in the precision instrument field.

The development is two synthetic oils "tailored" by research engineers of the Gulf Oil Corp. and Elgin National Watch Co. to fit the special lubricating needs of highly sensitive aircraft instruments and similar devices. Conventional petroleum lubricants for instruments are not entirely satisfactory for this type of equipment, according to Gulf.

The new lubricants—Gulf Special Instrument Oil and Gulf Micro Bearing Oil—are the end products of a two-year research effort at the Mellon Institute of Industrial Research, Pittsburgh.

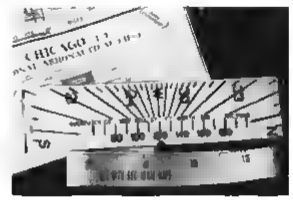
After studying 57 different oils, engineers realized the oil they were looking for simply didn't exist. So they created a new one and perfected it into the two grades now on the market.

Advantages claimed for the new synthetic lubricants:

• **They don't "creep"** or spread onto parts of the instruments where they're not wanted. They "stay put" for a long time when applied in minute quantities to small pivot-to-jewel or pivot-to-brass bearings.

• **They resist oxidation** and evaporation, permitting them to be used for long periods with a minimum of gumming or thickening.

Because of its lower evaporation point, Micro Bearing Oil is recommended over the "Special" where it is desired to get the longest possible service of the oil before a new application.



Navigation Computer

A navigation computer for private pilots which uses an elastic tape marked with time and fuel consumption figures to simplify and speed computations is being marketed by the Quickputer Co., Ft. Worth, Texas.

The firm says use of the device is not confined to private pilots. According to the company, the Air Force has shown interest and currently is running tests with the new instrument.

The Quickputer consists of a 6-in. rigid plastic scale on which is printed a 180-deg. protractor and a speed scale calibrated from 60 to 200 mph. The elastic time band is attached to one end of this scale.

Basically, this is the way the computer is used to find the length of time it takes at a given speed to fly between two points on a map:

• **Rigid scale is placed** at starting point on map.

• **Elastic time band** attached to scale is stretched along course line until an index arrow on the band is opposite the plane's speed on the rigid scale.

• **Time markings then will show,** at the point on the tape opposite the destination point on the map, the time required to fly the course. Markings on hand also will show time it will take to reach various check points.

Fuel required to fly a given course at a given speed is computed in much the same manner. Again, the rigid scale is placed at the starting point on the map and the elastic band stretched until a figure on it, corresponding to known fuel consumption per hour, is opposite the known speed of the plane. The number of gallons required for the flight is shown on the elastic band scale adjacent to destination point on map.

ALSO ON THE MARKET

High gain beacon antenna has gain of about 3 db., can be used for communication between local airports, control tower to aircraft on ground, various airline offices, etc. Maker says it permits use of low cost radio equipment. Address: Winkshup Associates, Inc., 135 Crescent Rd., Needham, Mass.

A complete hydrant type airport fueling system has been designed and patented by Erie Meter Systems, Inc. The system uses mobile dispensing units carrying hose from ground hydrants to aircraft. Patents also includes pumps and water removing units. Address: Erie, Pa.

A shock-absorbing anvil, recently developed by L. S. Starrett Co., can be fitted to any standard dial indicator with a solid contact point to convert it into a shock absorbing instrument. Internal spring in anvil does not interfere with normal functioning of indicator, cushions shocks and blows resulting from careless or rapid use of instrument. Thread size is No. 4-48. Address: Athol, Mass.

Another lightweight headset to arrive on the market is the "Bantam Freecover." This unit has a quick-adjusting ear piece, making it adaptable to all ear sizes, according to maker. It weighs less than ½ oz., is supplied with a 6 ft. cord and jack. Address: Dave Rumph Co., P. O. Box 4178, Ft. Worth 6, Texas.

Line of metal parts washers with solvent capacities ranging from 5 to 75 gal. are offered by Electric Heat Control Co. Steel washer tank is equipped with light fitting cover, basket to suspend parts in solvent, filter screen to clean solvent, and impeller set for 400 to 500 rpm. Large units have pump, hose and nozzle for rinsing. Maker says solvent loss is slight. Address: 9123 Inman Ave., Cleveland 5, Ohio.

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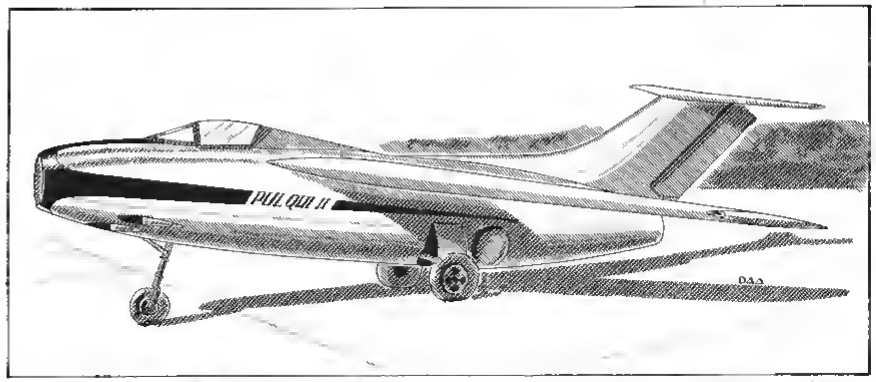


ARGENTINA'S latest turbojet aircraft is shown here in sketch based on Buenos Aires newspaper photo. Recognition feature is tee tail.

Pulqui II: Newest Argentine Jet Plane

Conventional layout of subsonic fighter shows German design features.

By David A. Anderton

First details of the Argentine Republic's newest jet fighter, Pulqui II, have become available despite the lack of official information on the plane.

Flown first on June 17 by Capt. Edmundo Weis, Pulqui (Arrow) II is the second Argentine jet. Two days later, on its next flight, the craft groundlooped on landing. It now is undergoing repairs.

Design credit for the airplane goes to Dr. Kurt Tank, late technical director of Focke-Wulf Flugzeugbau G.m.b.H. Builder was the Institute Aerotecnico de Cordoba, government aircraft factory. Argentina's first jet, Pulqui I, was designed by a French engineer, Emilio Dewoitine, and was flown about three years ago. It, also, was built by the Institute.

▶**Flight Data**—AVIATION WEEK's Buenos Aires correspondent was able to get little information on the Pulqui II beyond the photo and story which appeared June 18 in the official morning newspaper, Democracia.

The newspaper said that the plane took off for its maiden flight at Cordoba with Capt. Weis flying. A 400 meter (1300 ft.) ground run got it into the air, and from then on during the half hour test flight the plane performed well at altitudes up to 3000 meters (just short of 10,000 ft.).

Democracia claimed that speeds of 1000 kmph. (621 mph.) were reached, but the American Air Attache's office in Buenos Aires felt that 450 mph. was a more reasonable figure. Observers there were convinced that Weis, in common with other first-flight pilots, did not force the airplane.

▶**Second Flight**—On June 19 it was flown again, this time by Col. Ludwig Behrens, late of the Luftwaffe and once a Focke-Wulf test pilot.

Official story on Behren's flight was that an accident was sustained on landing.

Unofficial sources said the damage to the aircraft was confined to a washed-out landing gear and a bashed-in wing because of a ground loop at landing.

▶**Picture Analysis**—The sketch of Pulqui II reproduced here is from the photo in Democracia.

At first glance, the airplane appears to be a conventional jet layout, with intake in the nose. A shoulder-height wing is mounted on a fat fuselage. Tricycle gear of extremely narrow tread (which may have contributed to Behren's troubles) is used. A Rolls-Royce Nene powers the craft.

Chief recognition feature of the plane is the Tee-tail, with the horizontal stabilizer mounted at the upper extreme of the vertical fin.

A second glance at the picture shows some of the major points of design interest in Pulqui II's layout.

From the shadow cast on the ground, it would seem that the wing is of constant chord, probably with the now-accepted 35 deg. sweepback. The horizontal tail is tapered at about 2:1.

(Both these features were on a Focke-Wulf proposal made in early 1945 for a jet interceptor. The proposal aircraft was designated the Ta-187, taking its appelation from Tank's name.)

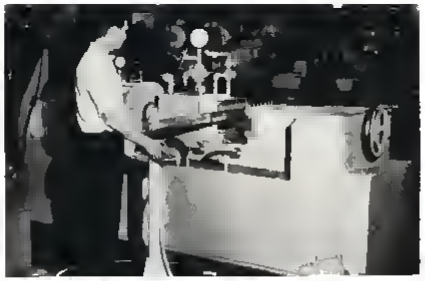
Narrow-tread landing gear also was featured on the FW proposal, and seems to have been picked up for Argentine use. It appears that the gear is of the single leg type beloved by German aircraft designers and that it retracts around a skewed axis, without folding, to fit into a fuselage well.

The Tee-tail was a conspicuous item on the Ta-187 proposal, with a notable difference in the span-chord ratio of the vertical tail. The earlier German proposal showed a vertical surface about three chords high. Pulqui II's is more like one chord. It's a safe bet that the latter choice was made because of the possibility of tail flutter.

Armament is probably four cannon.

▶**Mixed Breed**—Democracia calls the new jet an "all Argentine" fighter. But the fact remains that it was designed by one of Germany's best engineers, test flown by a former Luftwaffe pilot, and has a British engine.

In sum, Argentina's latest fighter appears to be based on a design that is conventional and five years old, and likely will turn in a performance that is creditable, but not amazing.



MILLING MACHINE at Boeing Seattle plant can handle 85 ft long spar, automatic joggler will replace three punch presses

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REPRESENTATIVES IN LOS ANGELES SEATTLE DALLAS CHICAGO DETROIT BUFFALO, PHILADELPHIA, BALTIMORE NEWARK NEW YORK MONTREAL

Largest Miller

Boeing's new machine, leased from Onsrud, said to be world's biggest.

Boeing Airplane Co. has installed at its Seattle, Wash., plant what it claims is the largest milling machine in the world. Manufactured by Onsrud, the leased machine is capable of handling an 85 ft. long wing spar. (Boeing's present capacity is a 35-ft. length.)

Unique feature of the machine is an air feed lubricating system, engineered by the Sun Oil Co. This system includes a visual device by which the operator can check the oil flow through the 12 lubricating lines. In the event of line clogging, the operator can either blow the line clean manually, or let the machine blow it clean when the oil reaches a preset limit level.

The milling machine can have two cutters on horizontal, two on vertical at the same time. It operates automatically on some cutting operations and has an automatic air cylinder for raising and lowering router heads on the miller.

►**Press Replacement**—Further speeding of production should be possible with the use of a new jogging machine. This special-purpose tool was designed and built at Boeing to perform operations previously done on punch presses. It is expected that the work of three presses will be handled by one machine.

Indication of the capacity is Boeing's figure of 360 longerons joggled per hour, either rolled or extruded sections in sizes up to 7 × 7 in. in any length.

The jogging machine is completely automatic, hydraulically powered, electrically controlled and timed, with handwheel controls for setting the joggle length, depth and desired angle of springback.

It is designed for either hot or cold jogging with thermostatically controlled superheated steam circulating through the dieholders.

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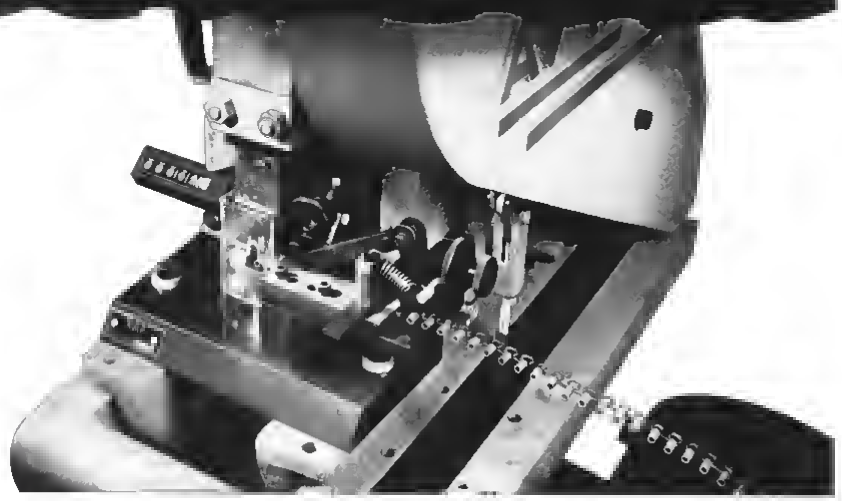


SUBMERGED LAUNCHER for 5 in. spin-stabilized rockets replaces externally hung projectiles, trebles firepower of Skyraider.

Service Demands Cause Design Changes

Firepower and range increases are achieved by external appendages.

WING-MOUNTED ROCKETS for F9F-2B are flight tested on factory –3 Panther.

EXTRA TANKAGE is supplied on the F-86 Sabre from two non-droppable "banana" tanks

Increased range and more offensive firepower for military aircraft are continuing demands of the services.

To meet these demands, field and factory modifications or additions are quickly engineered. But since the aircraft's internal structure has generally been frozen by then, and production is well under way, the first tendency is to consider where, on the outside of the airplane, the particular solution to the problem can be hung.

That is the reason for the clean production airplane of today becoming the service "Christmas tree" tomorrow.

Here are assembled some of the most recent cases of airplane festooning and modifications to meet combat needs.

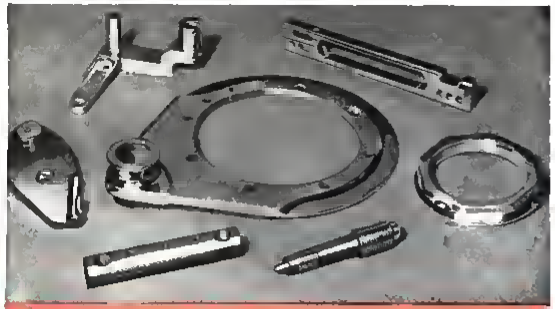
► **Panther Punch**—Normal armament of the Grumman F-9F series is four 20mm aircraft cannon. This offensive wallop is augmented, in the F-9F-2B, by a half-dozen 5 in. rockets and a pair of 1000-lb. bombs.

The in-flight picture of the Panther shows only the rocket installation. This particular ship is an F-9F-3, being used for flight test work.

But more intriguing than the revised armament is the appearance of a set of fuselage air brakes, visible in the picture as a group of perforations in the bottom of the fuselage, just ahead of the leading edge of the wing.

► **Sabre Succor**—North American's F-86 fighters are sporting a new external gas tank to give them increased range.

The first in-flight photo shows the somewhat unconventional shape of the



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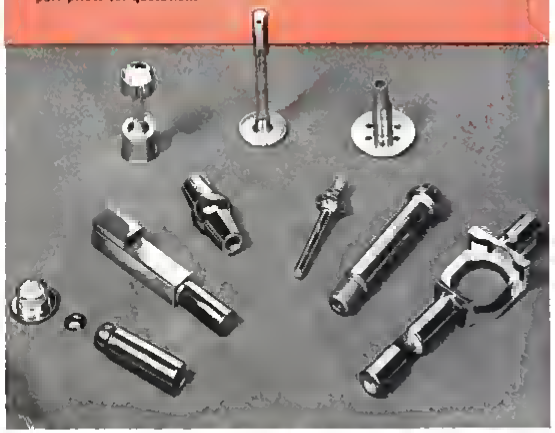

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tank, which has led to its application of "banana shaped."

From this and other photographs, it would appear that the tanks are elliptical in cross section, with the major axis parallel to the wing chordal plane. Tank centerline is swept up at the trailing edge, probably to match the airflow pattern around the wing.

In keeping with the trend of the times, the tank carries a horizontal fin for stabilization during jettisoning.

North American claims that the new tanks have very little effect on performance, in fact, they are intended to be kept on during combat. Further, NAA says that the tanks do not limit the dive speed of the Sabre because of buffeting. It was trouble with buffeting caused by earlier ferry tanks on the F-86 that led to the design of these banana tanks.

All Sabres coming off the production line will be equipped with the new tanks, and earlier models will be service fitted to modernize them.

► **Skyraider Special**—Pictures of the broadside toting Douglas AD series, which show it carrying everything aloft that could conceivably be carried aloft, have prompted questions about the advisability of retracting the landing gear to reduce the drag.

(Through no fault of the Douglas designers, the Skyraider has been impressed into service in a number of ways, and has been festooned with all manner of drag-producers. That it has succeeded as a multi-purpose threat is a tribute to the airplane.)

Prompted perhaps by an early picture of the AD, and others like it, the Navy has come up with a special modification to get rid of the external rockets on aircraft.

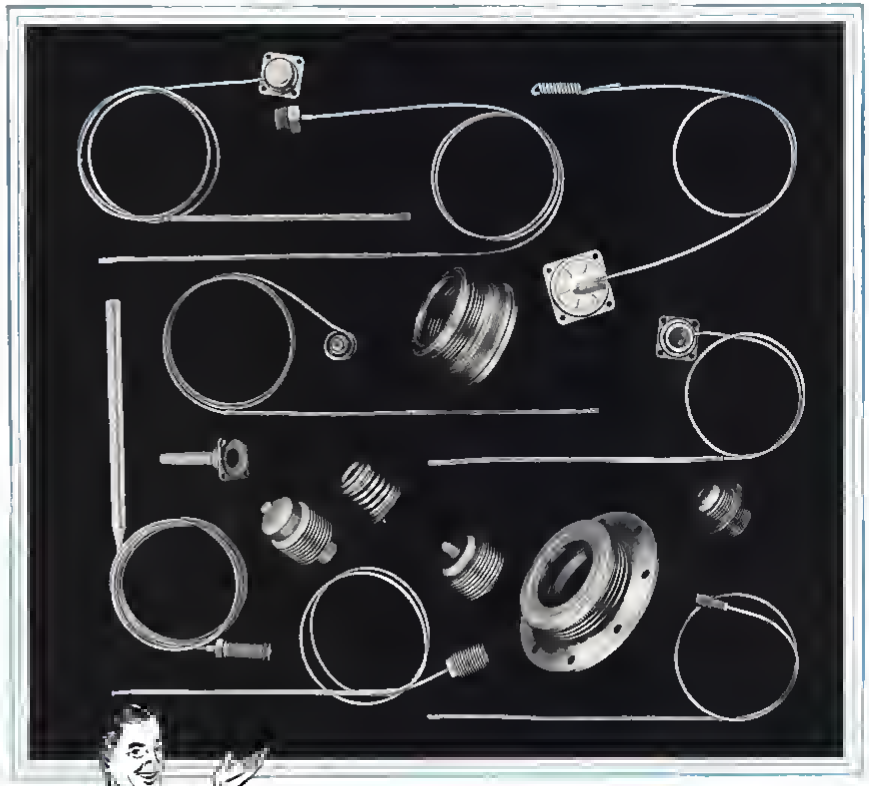
Base feature of the modification is the internal mounting of two multiple rocket launchers. Thirty eight 5-in. spin stabilized rockets can be fired singly, or at a cyclic rate of three per second from the launchers mounted in the AD outer panels.

That means that in 6½ sec. the pilot can throw ¾ of a ton of rockets at the opposition.

Blast disposal is taken care of by emitting the exhaust nozzles from the launcher blast tubes down and aft.

Total weight of the rocket launchers is 160 lb. Rockets are designated Aero X10A, are finless and stabilized in flight by spin imparted to the projectile.

It would seem that a fair amount of work would be necessary to make the Skyraider outer panels receive the launchers and rockets. It would also seem that this particular installation is not a precursor for the rest of the AD line. The most likely assumption is that this is a single test installation out of which will come engineering data for future use on what should be cleaner aircraft.—D.A.A.



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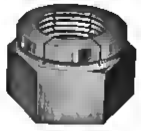

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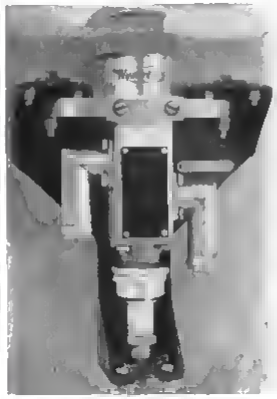

Special Valve in British G-Suit

(*McGraw-Hill World News*)

A mechanical device to increase the structural limit of modern man has recently been developed in England as an outgrowth of extensive research into the effects of high G loadings.

Requirements of the Royal Aircraft Establishment at Farnborough resulted in the design and development of a new G-suit, of which the significant component is a control valve.

▶**Compact Unit**—The new valve was designed and built by the Hymatic Engineering Co., Ltd., of Redditch. A compact unit, it consists of 89 separate, precision-machined parts.

It operates from a supply of compressed air at 20 psi., fed from high pressure air storage bottles, which may either be charged on the ground (before takeoff) or be charged from the plane's own air compressor unit.

In the valve, a balanced poppet mechanism unaffected by low G accelerations, controls the air supply to the various parts of the suit. A special pressure-relieving device is included to insure that the pressure built up in the suit never becomes so high as to be uncomfortable to the wearer.

▶**Flight Tests**—The valve is being tested at present in the de Havilland Venom—Britain's latest and most powerful single-jet high altitude fighter. At the same time, in order to compare operating characteristics with the two types of aircraft, the valve is also being tried out in the piston engine Spitfire.

Biggest problem faced in the development of the suit was the matter of the compressed air supply. This could not be satisfactorily drawn from the compressor of gas-turbine power plants for that air had to be cooled and its

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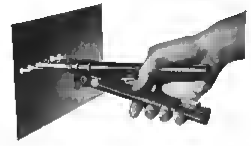

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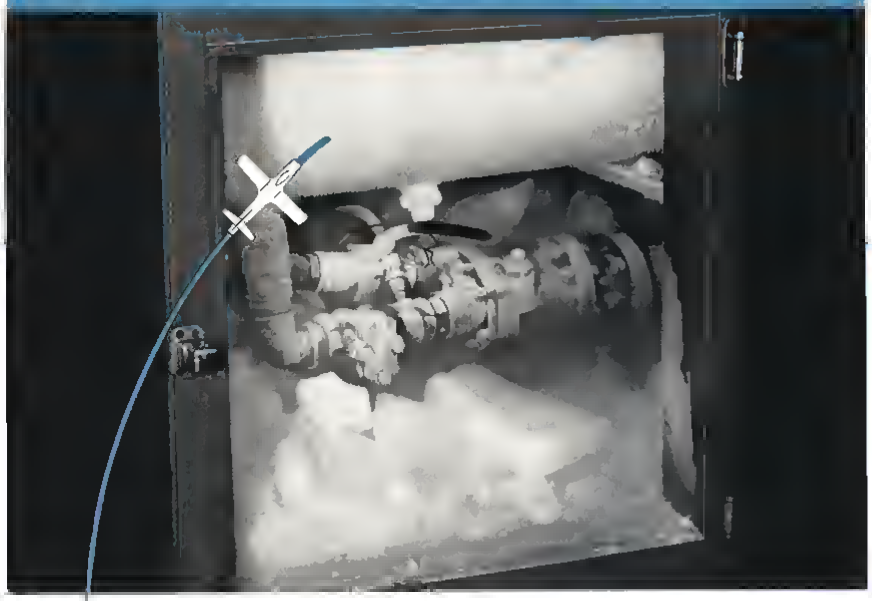

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pressure reduced and stabilized. Furthermore, such a source of supply proved insufficient at high altitudes or when the engine was throttled back before making a dive. In a sharp pull-out after the dive, or a tight turn, the suit would be of little or no use to the pilot. Hence, an independent source was selected for the compressed air-storage bottles.

The valve is designed to be insensitive to shocks of short duration, such as might be caused by taxiing on a rough airfield or by rough air in flight, yet should respond with unvarying regularity to the changing G loads encountered during complicated high-

NACA Studies Roll Phenomena

Two important related contributions to the understanding of roll phenomena in supersonic aerodynamics have been published recently by the National Advisory Committee for Aeronautics as technical notes.

Linearized theory is used:

- **To estimate the damping** in roll of a wing-body combination.
- **To calculate the stability derivatives** due to roll for sweptback tapered wings.

In both cases, the wings are considered to have supersonic leading edges; that is, the component of velocity normal to the wing leading edge is supersonic.

► **Roll Damping**—Most previous studies of supersonic damping have been made for an isolated wing. Since such a configuration is rarely found in actual practice, some means of estimating roll damping for the conventional combination of wing and body had to be found.

NACA's study was based on the consideration of rectangular and triangular wings mounted on cylindrical bodies.

An approximate source distribution was used to represent the interference effect of the body on the wing, the limitation imposed by this was shown to have small effect.

Two further assumptions serve to limit the analysis. The first is that of vanishingly small wing thickness, which may be expected to have small effect. The second, which NACA considers as possibly the most severe of all three limitations, is that of an inviscid fluid. Error due to this assumption is almost impossible to evaluate theoretically, and there is not much available experimental data at hand.

► **Design Charts**—Results of the estimation are presented in charts for rectangular and triangular wings on a cylindrical body. The damping-in-roll derivative is plotted against a dimensionless ratio of body radius to distance from body centerline to wingtip.

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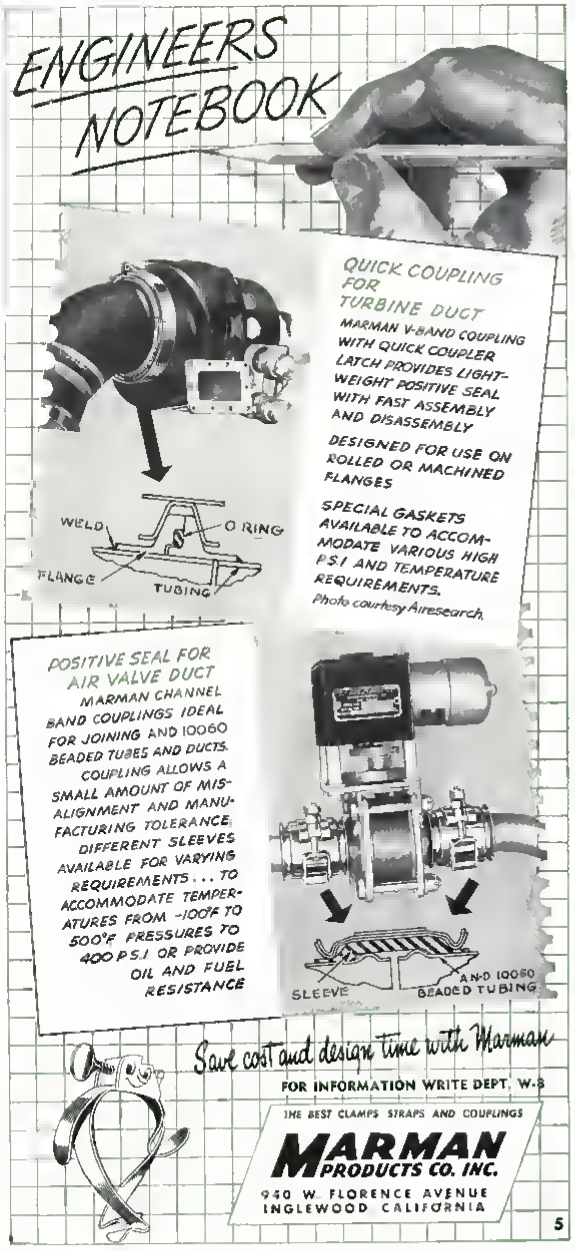


curves are drawn for several values of aspect ratio

Additional design information is presented in the form of charts which illustrate the effect of the presence of the body.

▶ **Stability Derivatives**—Calculations of the lateral force and yawing moment due to roll (for supersonic wings) are based on the assumptions of supersonic leading edges, streamwise tips, swept trailing edges (which may be either subsonic or supersonic provided the taper ratio is less than or equal to one).

Further restriction is that Mach lines from either wingtip must not intersect the other tip.

▶ **Results**—Final answers are presented as design charts for both stability derivatives as functions of a sweepback parameter for six aspect and four taper ratios.

Both these publications were issued by the Langley Aeronautical Laboratory. Tech. Note 2151, "Estimation of the Damping in Roll of Supersonic-Leading-Edge Wing-Body Combination," is by Warren A. Tucker and Robert O. Piland. Tech. Note 2156, "Theoretical Calculations of the Lateral Force and Yawing Moment Due to Rolling at Supersonic Speeds for Sweptback, Tapered Wings with Streamwise Tips—Supersonic Leading Edges," is by Sidney M. Harmon and John C. Martin.

Stator Assemblies Made New Way

Development of a rapid and economical method for manufacturing compressor stator assemblies for jet engines has been announced recently by Wellworthy Pistons, Ltd., Lymington, Hants, England.

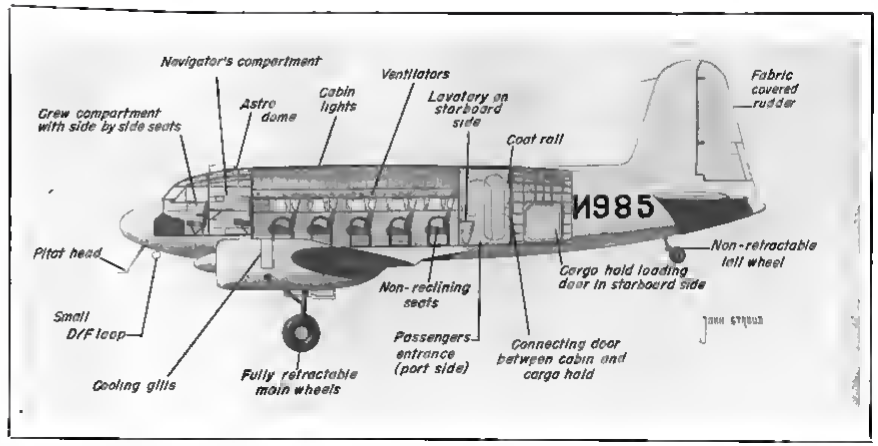
The method bonding of a bright drawn steel airfoil section to an aluminum alloy root by the Al-Fin process. Wellworthy is licensed by Al-Fin Division of Fairchild Engine and Airplane Corp.

▶ **Easy Machining**—Big annoyance in the manufacture of compressor stator blades is the machining process for the root section. Anything done to simplify the procedure reduces both the time and the cost of machining.

Steel strip used in the process is obtained from the mill in the bright drawn condition. Extremely close manufacturing tolerances are held by the mill. The strip is cut to length and bonded to the aluminum alloy root.

Possible future development of a segmented blade unit is foreseen, where a number of blades or even a complete stage ring can be made in one piece by bonding the steel blades to the aluminum alloy root section.

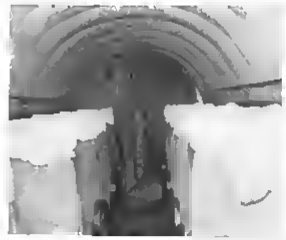
Wellworthy has announced that blades manufactured by the process are currently undergoing study. No production plans were mentioned.

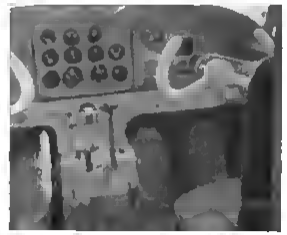


SOVIET FEEDERLINER, Yak 16, is being used on far-flung Aeroflot system as replacement for older aircraft and sister ship to Soviet DC-3 (LI 2). Designed by Alexander Yakovlev, more famous for his fighter aircraft, the plane is clean and conventional.

Soviet's Newest Feederliner: Yak 16

Aeroflot, Soviet airline, modernizes system with 10 seat replacement.





SPARTAN SIMPLICITY of Yak 16 interior is emphasized by functional cabin layout, lacking in luxurious decor. Uncluttered appearance of pilot's position is noteworthy.

The Yak 16, Soviet Russia's latest feederline transport, is a far cry from its more warlike hangar-mates designed by Alexander Yakovlev—but it is indicative that the Reds have not lost their interest in transport aircraft.

Basic mission of the Yak 16 is to share the local traffic work with the LI 2 (Soviet DC 3) and to replace some of the much older planes used for short hauls.

▶ **Ten-Place Aircraft**—The Yak 16 is a low-wing monoplane of metal construction which carries a normal load of ten passengers, some luggage and three crew members.

The plane has a comfortable cabin which seats five passengers on either side of a central aisle. The chairs are not adjustable, a matter of little importance on short hops. There is a large window and an individual ventilator for each passenger.

At the rear of the cabin on the starboard side there is a lavatory and washroom. Between the rear of the cabin and the cargo hold is a coat rail and a luggage rack.

▶ **Front Office**—The crew compartment is divided into two sections. The pilot and copilot sit in a well-planned flight cabin. Aft of that is a navigator's compartment on the starboard side. Portside compartment holds luggage.

Instruments are in three sections with the blind-flying panel and main flight instruments mounted before the pilot. All engine instruments are mounted centrally. Copilot's panel contains only radio gear.

Control columns are mounted at the outside of each pilot's seat. Brakes are operated by hand from a grip on the port control wheel. Engine, fuel, prop, flaps, landing gear and trim controls are pedestal-mounted between the two pilots.

Both windshield panels are fitted with anti-glare screens, and there is a direct vision panel for the first pilot.

▶ **Performance**—Yak 16 cruises at a reported 180 mph. at 5580 ft. Its service ceiling is 16,400 ft. Take-off run under unspecified conditions is given as 850 ft.

Wingspan is given at 56 ft.; length, 36 ft. Gross weight at takeoff is 14,100 lb., of which 3000 lb. is the payload. Fuel capacity is 198 imp. gal.

These performance figures are obtained with two Asch 21 seven-cylinder, aircooled, radial engines, equipped with Arctic shutters within their clean cowlings.

Powerplants are rated at 620 hp., with 690-700 hp. available for takeoff.

▶ **Foreign Sales**—Attempts have been made to sell the Yak 16 to Finland, Hungary, Poland and Czechoslovakia, but apparently without success. There have been reports that this type was used by the Soviet-Yugoslav airline JUSTA, but that line has since been disbanded by Yugoslavia.

Now in use on Aeroflot, the Soviet airline, the Yak 16 is making milk runs between such wonderfully named places as Minsk and Pinsk, Irkutsk and Yakutsk.

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To meet this challenge, Martin engineers are designing aircraft as integrated airborne systems, not merely as flying vehicles whose sole goal is speed Whether planning a U S Navy Viking rocket, a jet-powered Air Force XB-51 or a modern airliner Martin engineers work with all three elements of airframe and power plant electronic flight and navigational controls and military armament or passenger facilities And design work is so scheduled that the end product represents a completely coordinated system For there is no point in having an airframe ready for flight testing while the electronics system which may alter the airframe is still a gleam in the designer's eye

This is Martin *systems engineering*—a new beacon to pierce the blackness of the *unknown*— developed from Martin's background of far-reaching advances on top level missiles projects. This is why radar servo-mechanism automatic control, automatic computer and antenna experts —as well as aerodynamicists structural engineers and electrical hydraulic, armament and power plant installation specialists—are all part of the well integrated engineering team Martin offers its customers today! THE GLENN L. MARTIN COMPANY, Baltimore 3, Maryland

MARTIN VIKING *U S Navy high altitude research rocket holder of altitude record for American built single stage rocket*

MARTIN KDM 1 *U S Navy* target gliding ram jet powered radar tracked radio controlled

MARTIN XB-51 *U S Air Force's first jet powered ground support bomber*

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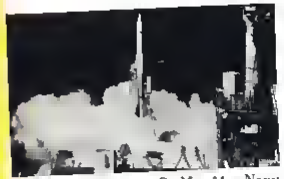
Facts on the Air Age

by The Glenn L. Martin Company, Baltimore 3, Maryland



New Rocket Record — On May 11, a Navy Martin Viking zoomed 106 4 miles into the upper atmosphere from the deck of the U S S *Norton Sound* in the Pacific, setting a new altitude record for an American-built, single-stage rocket. Reaching a top speed of 3600 m p h, the Navy rocket carried instrument instruments which recorded data about cosmic rays for future study. The information was flashed back to the ship by an automatic radio transmitter in the missile.

This was the first time that the Martin Viking, largest U S upper atmosphere research rocket, had been fired from a ship, a Navy seaplane tender converted into an experimental guided missile ship

World Safety Mark — U S flag airlines operating international set a new world safety record on April 14, by completing two years without a single passenger fatality During the two-year period, the American air carriers flew nearly three billion passengers approximately four billion passenger miles, also a world record for airlift The carriers operate 203 678 route miles international, serving 239 foreign points on all continents

Aircraft Design Advances — With piloted aircraft following guided missiles past the sonic barrier, man's physical limitations are creating new problems for aircraft designers who must give him the assistance of mechanical and electronic senses muscles and nerves! To meet this challenge, Martin engineers are designing aircraft as integrated airborne systems, not merely as flying vehicles whose sole goal is speed In this *systems engineering* Martin designers work with all three elements that go to make up a complete, modern airplane or missile—airframe and power plant, electronic flight and navigational controls and military armament or passenger facilities And the complete development is so scheduled that the end product represents a completely coordinated system

Wind Speeds — exceeding 7500 miles per hour, surpassing anything ever dreamed by prewar air scientists, have been obtained in a new wind tunnel announced by the Naval Ordnance Laboratory at White Oak, Md Penetrating for the first time in history into mysterious realms known as "hyperspace," the new tunnel is regarded by government scientists as the first step in basic research which may some day lead to scientific machines which will girdle the globe in minutes and open that far reaches of the universe to man

Jet Trainer — A new model of the wartime Link Trainer has been okayed by the U S Air Force to combine ground training in flight, engine and radio navigation in high-speed jet planes Rates of roll, climb and acceleration are faithfully duplicated and controls are loaded in pressures vary with air speed. An integral part of the new trainer is emergency controls with which a check pilot behind the cockpit can introduce a variety of operating troubles, The instructor can make the fuel pump or hydraulic system fail, stir up a thunderstorm, have a fuel tank punctured by flak, or create any other flying hazard

Pilotless Aircraft, flying at evasive courses with the speed and maneuverability of jet fighter planes but controlled from afar by radio, will soon be testing the Navy's big antiaircraft guns. The aircraft will be Martin KDM-1 pilotless target drones, several of which have already been delivered for firing into the "mother" aircraft which will carry them aloft for launching. The KDM-1's are the result of successful flights made by the Gorgon IV pilotless aircraft which was designed and built by Martin in cooperation with the Navy to test the possibilities of the ram jet engine

The KDM-1's, which have a wing span of only 10 feet, are released at the desired altitude from a pylon near the wing tip of the "mother" airplane From then on they fly on their own ram-jet power, controlled from afar by radio while being watched on a radar screen Controls may be preset before launching, but may be overridden by radio at the discretion of the distant control officer.

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The executive model seats four passengers in exceptional comfort with a fifth seat and table for secretary or stenographer. Many industrial, executive and private owners are among the operators of the 300 Doves to-day in service in thirty countries

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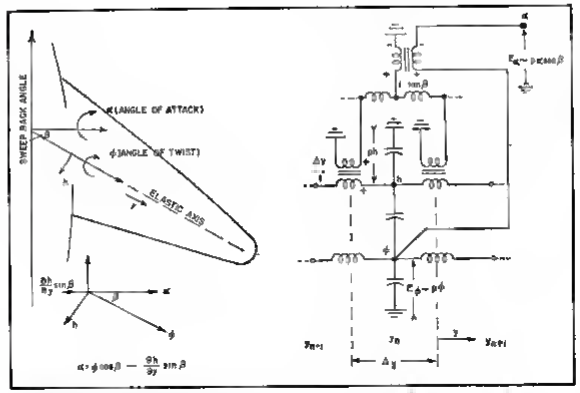

ELECTRICAL ANALOGY for elastic structure of sweptback wing shows coordinate transformation from elastic axis to airstream by use of electrical transformers

Analog Computer Aids Plane Design

Caltech electric brain rapidly solves lengthy and complex problems of aircraft structure and aeroelasticity.

Complex problems of aircraft structures can be resolved in short order by an electric analog computer operated as part of the Analysis Laboratory at the California Institute of Technology.

Smaller brother on the many-branched family tree of calculating machines, the analog computer is a simple, easily-operated, economical device. It will solve problems not demanding of better than one percent accuracy, and solve them rapidly.

Caltech's computer was the first of its kind to go into service, now, it has three years experience in aiding the aircraft industry.

► **Parallelisms**—Fundamental operating principle of the electric analog computer is that analogies exist between the components in mechanical systems and electric circuits.

Take for example a mass inertia (mechanical) and an inductance (electrical). The mass tends to maintain a constant velocity because of its inertia, the self-inductance of a coil tends to oppose any change in current. By comparing equations for the inertia force and the self-induced voltage, analogies between force and voltage, and velocity and current can be shown in addition to one between mass and self inductance.

► **Circuitry**—By using the complete set of analogous electrical components, a mechanical system can be set up as an electrical circuit with properties exactly analogous to the mechanical properties of the system being studied. These circuits have been developed to the point where they are suitable for a very wide range of applications, including such diverse ones as transient heat flow, automotive vehicle rideability and dynamic beam loading problems.

This all sounds very easy—and it is, for simple systems. But the advantage of the analog computer is not that it solves simple problems, but that it will quickly and easily give the answers to some very complex ones. And for these the circuits are not so simple. They require some time to work out.

► **Operation**—In Caltech's computer, electrical components are available through the medium of plugboards for circuit element cabinets. Once the circuits have been determined, they can be set up quickly with these boards.

In contrast to other types of electric analog computers, electrical resistance, inductance, capacitance and transformer circuits are used by Caltech for simulation of the linear terms of algebraic and differential equations.

Known functions of the independent variables are impressed on the system by forcing functions, in the form of steady state, sinusoidal, variable-frequency, square wave transient or even completely arbitrary functions of time. Amplifiers represent negative impedance terms. Non-linear expressions of the equations are handled by ten multipliers which can multiply any two variables. Eleven arbitrary function elements form dependent variable functions. Any special non-linearities (missile rudder limit stops, for example) are available through five current or voltage limiters.

► **Answers**—Solution of the problem is obtained by measuring the output voltage, current or charge on a particular circuit.

In the case of transient solutions, the answers are displayed or recorded by cathode-ray oscilloscopes. Steady-state solutions are measured either with vacuum-tube or dynamometer-type meters.

Now, of course, the aircraft engineer is interested in what sort of problems can be handled by such a computer. The first answer is lengthy ones—problems which take a great deal of calculating time. But there is a modification to the first answer which is also important, and that is that the problem should not demand a solution accuracy of better than one percent.

This is not really a limitation, however, because the general problems of aircraft design rely on data and assumptions that, on a good day, are possibly correct to within five percent. And in this category come most aircraft vibration and aeroelastic problems. Analyses of automatic control systems would be another genus of problems suitable for such a computer.

► **Complete Airplane**—The elastic structure of an entire aircraft can be set up in detail and analyzed. Wings, fuselages and stabilizers can be represented either as beams with combined bending and torsion, or as variable thickness plates. Beam equations are evolved in finite difference form; then solutions exist for bending deflections, slopes, angles of twist, shears, torques and torque loadings.

The structure thus simulated can be analyzed not only for static loading conditions, but even for the very complex transient conditions obtained, for example, during flights through gusts. Other transient analyses would include landing and taxiing shocks.

► **Three-Year Service**—Full time use of the Caltech computer has been going on for about three years, during which time a great number of aircraft problems have been solved. Enumerated among these were a complete airplane

MID CONTINENT Airlines Mechanic Leslie Ericksan relies on

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Precision tools and skilled workmanship assure on-time operations. Over and over again, Snap-on tools prove their worth in speed, efficiency and in meeting aviation standards for exactness. Check the actual working performance of Snap-on tools . . . notice the advanced design, detailed workmanship, fine balance, and perfect fit. You will be money and time ahead when your mechanics have a Snap-on tool for every service operation

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vibration analysis, wing vibration analysis and gust loading for Douglas; taxing and landing shock analysis for Lockheed; wind tunnel vibration study for Caltech; and a rocket vibration problem for NAMTC.

Capacity of the computer has been doubled since operations began, and it is possible to add more. Demands for use of the computer have been so many that there has not been enough time available, even with the doubled capacity, to handle all the requests.

► Acknowledgment—AVIATION WEEK is indebted to Dr. G. D. McCann, Director of the Analysis Laboratory at the California Institute of Technology, for background material furnished for this article, and is responsible for conclusions and inferences drawn from Dr. McCann's data.

Dynamic Stability, Control Simulator

A dynamic stability and control simulator has been developed for the Navy by M.I.T. to perform the laborious calculations involved in analysis of aircraft flight characteristics. The new machine is expected to reduce the time, expense and number of conventional flight tests by determining flight characteristics in advance.

The flight simulator consists of a battery of computing machines and a "flight table" consisting of an arrangement of gimbals suspended so that they can incline freely in any direction and supported on an independent foundation to eliminate vibration. The gimbal frame is operated by very high speed hydraulic servo mechanisms which automatically control instruments that carry out motions in accordance with electrically transmitted commands. It is used to orient the automatic control system of a theoretical plane or missile just as it would be tested in actual flight. The motions of the gimbal frame table are recorded for study by engineers.

A problem is set up on the apparatus by setting electronic computer dials that represent such characteristics as weight, speed, altitude, wing span, etc. Then the question is fed into the simulator, by applying appropriate electrical signals through a control board. The answer is returned on a chart on a recording apparatus in a matter of seconds.

The project was headed by Dr. Albert C. Hall, director of the MIT Dynamic Analysis and Control Laboratory. Among MIT scientists contributing to the project were Dr. John F. Blackburn, development of automatic controls and supervision of mechanical design of the gimbal frame; Emery St. George, Jr., development of instruments

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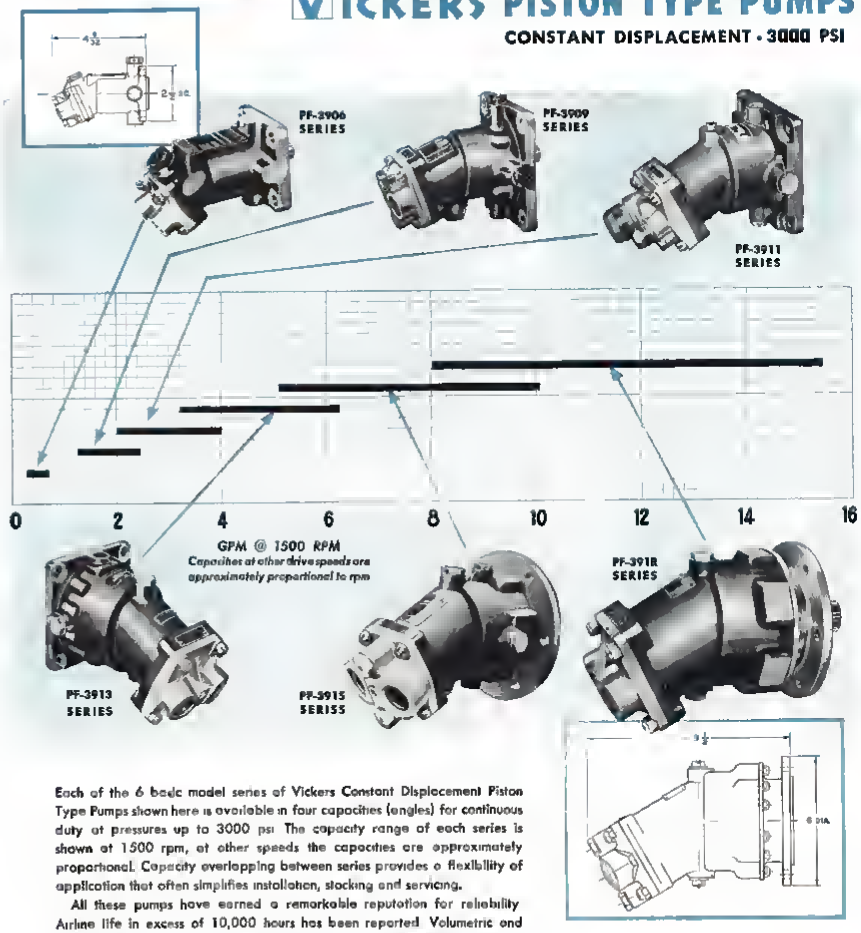

Each of the 6 basic model series of Vickers Constant Displacement Piston Type Pumps shown here is available in four capacities (angles) for continuous duty at pressures up to 3000 psi. The capacity range of each series is shown at 1500 rpm, at other speeds the capacities are approximately proportional. Capacity overlapping between series provides a flexibility of application that often simplifies installation, stocking and servicing.

All these pumps have earned a remarkable reputation for reliability. Airline life in excess of 10,000 hours has been reported. Volumetric and overall efficiency are very high. Small size and extremely high horsepower to weight ratio are notable characteristics. Write for Bulletin 49-53 describing Vickers . . . the most complete line of hydraulic equipment for aircraft.

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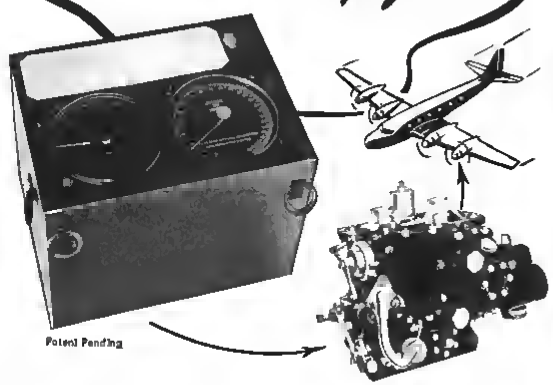

Patent Pending

The Aircraft Carburetor Tester, Greer Model HCT-1 shown here, was especially designed to provide a light compact unit for testing Stromberg Injection Carburetors right in the aircraft under flight conditions.

Of sturdy construction and fully equipped to test all models of injection carburetors, the unit weighs under 25 lbs., and measures only 12 x 9 x 10 inches—small enough to fit comfortably on the operator's lap while sitting in the aircraft.

Connection is made directly into the engine fuel system between the pump and the carburetor and fuel flow is accurately measured by means of an aircraft type autosyn transmitter and indicator system. A differential gauge connected to the diaphragm chambers in the carburetor accurately indicates the pressure differential between the two chambers.

In addition to providing a faster and simpler method of carburetor testing, the unit has the advantages of permitting testing under actual operating conditions such as: diaphragm chamber pressure, engine vibration and impellet chamber suction.

A request for further information on your company letterhead will bring you a prompt reply with complete specifications.

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and electronic components, Charles M. Edwards, design and development of the electrical computer, and Thomas F. Jones, Jr., in charge of simulator.

Meteor Trail Drift Tags Wind Speeds

Cyclonic winds in the ionosphere can be measured electronically, using a method developed by three scientists at Stanford University, Stanford, Calif.

Their research analyzes the drift of meteor trails to measure wind speeds and directions at altitudes of 55 to 80 miles above the earth, more than twice that obtained with sounding balloons. Measurement is based on the reflection of radio waves by electrical disturbances caused by the heat of a meteor's passage. The disturbances can be detected by a radar like technique.

▶**Useful in Design**—The scientists, L. A. Manning, O. G. Villard, Jr., and A. M. Peterson, of Stanford's electronics research laboratory, developed the technique under the auspices of the Office of Naval Research. The basic data obtained from their experiments are expected to have useful applications in design of long range guided missiles (where knowledge of the upper atmosphere is a must) and in weather forecasting.

General results of the program so far indicate that at the altitudes considered, wind velocities vary from day to day over a range from as low as 30 mph. to as high as 125 mph.

Cast Resin Improves Avionic Circuitry

Stability and ruggedness of chassis-less avionic circuits is improved as a result of the development of a special casting resin by the National Bureau of Standards.

The resin had to have low viscosity, low coefficient of expansion, low dielectric constant and power factor, and high leakage resistance. The casting material had to become hard on polymerization, but could not be permitted to shrink excessively because of possible damage to the electronic components.

Most of the commercially available resins tested failed to meet all these specifications, so NBS initiated a development program.

Its findings are published in Circular 493, Development of the National Bureau of Standards Casting Resin (available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for 10 cents a copy), which describes test procedures and results, formulation and preparation techniques and gives the properties of the resin.

How High Must Production Go?

New goals for doubling output still below the tripled rate called for by industrial mobilization plans.

By Rudolf Modley*

The aircraft industry has just been served notice that it is expected to double its output. Roughly speaking, this means that military production would have to increase from a level of about 3 million pounds a month to about 6 million. And the number of military planes produced would probably be between 5000 and 6000 per year.

From the point of view of company management, it will be a tremendous task to accomplish this acceleration within the framework of a peacetime economy where the industry has to compete for manpower and material. But it will help us to reduce the expected output to its true dimensions if we compare these figures with wartime peaks accomplished only six years ago.

▶**Back to Pearl Harbor**—The 16 million pounds will compare with almost 90 million pounds produced in March, 1944. And production in March, 1944 alone was more than 9000 aircraft. That means that in a single month of the war we produced 50 percent more planes than the accelerated schedule calls for in an entire year.

Roughly speaking, the production level expected from the aircraft industry for 1951 will equal about 5 percent of the 1944 production level. If the present plans are fulfilled, the industry in 1951 will produce as many planes as it did in 1940 and as much airframe weight as it produced in 1941. We are now trying to reach production levels which prevailed before Pearl Harbor.

▶**No Mobilization**—Mobilization planners consider it possible to triple aircraft production every year once they receive the go-ahead signal. That means that for every pound produced in the first year there would be produced three pounds in the second, nine pounds in the third, 27 in the fourth year, etc.

Actually, the ratio was somewhat better in the last war. Taking 1940 airframe weight produced, including spares, as the basis we find the following ratios: 1 : 3.5 for 1941, 11.9 for 1942, and 30.2 for 1943. The peak of production was reached early in 1944, so the three-fold rate of increase does not apply for that year. There are good reasons to believe that this ratio could be improved if we went into full scale mobilization at present, provided that there is no sabotage or bombing.

If we compare this potential tripling of output with the proposed doubling of present levels we can see that any talk of "mobilization" of the industry is without any basis of fact. Only demands for tripling (or more) of current levels can rightfully be considered as all-out mobilization orders.

Difficult as the planned acceleration of aircraft production may turn out to be, there is no mobilization of the industry today. But such a mobilization may become necessary tomorrow. It may therefore be worthwhile to review some aspects of the capability of the industry to mobilize, and to compare our position today with that of 1940 when, after the fall of France, we found ourselves in a similar position.

▶**Then and Now—In** 1940 the concept of air power in the military sense of air forces was being grasped eagerly as a "get-rich-quick scheme" by a frustrated American public which saw Europe submerged by Hitler. Before then, only a few far-sighted leaders had any realization of the role American air power was destined to play in the future.

In 1938, Gen. H. H. Arnold had begun to set the sights of his Air Corps and of the aircraft manufacturers toward procurement levels of tens of thousands of planes. But Congress felt differently, and while Arnold talked of tens of thousands the Air Corps and the Navy received only a few hundred.

It was at the end of 1938 that Roosevelt gave the first evidence of having been converted to air power. But it was only on May 17, 1940, that he went before the Congress with the historic call for 50,000 planes per year. Before the month was over Henry Ford went Roosevelt one better by stating that his company could "swing into the production of 1000 airplanes of standard design a day." In that same month of May, 1940 we produced 480 military aircraft. Many of the new converts to air power had little realization of the difficulties which lay ahead.

Today the need for air power—a balanced combination of capacity, military air forces, and air transporta-

*Mr. Modley is consultant of the Aircraft Industries Assn., and author of "Aviation Facts and Figures." McGraw Hill Book Co. 1946. A previous article, "Minimum Wage Industry Lesson" appeared in AVIATION WEEK July 3, 1950.

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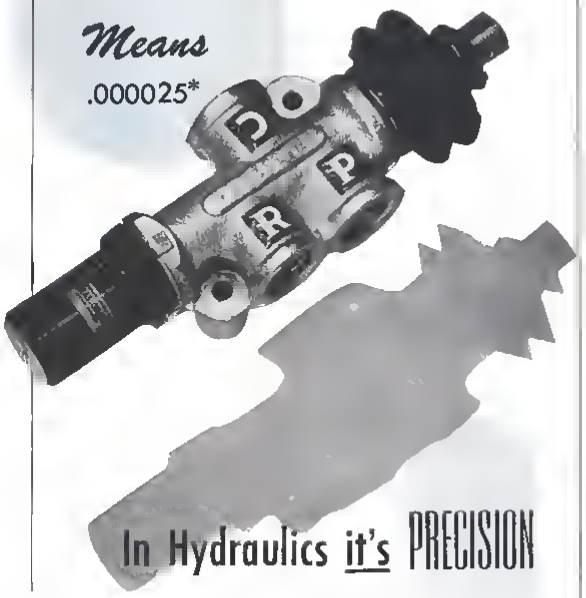

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tion of men and goods—is more fully understood. So are the difficulties of attaining it. The problem has been probed by a Presidential Commission and a Congressional Board. And the major findings of these bodies have been generally accepted by the Congress. As a matter of fact, the present accelerated aircraft procurement program may well be considered a belated attempt of the government to catch up with the recommendations of these bodies, with the actions of Congress and with public opinion.

▶ **Physical Resources***—Minor changes have occurred since 1940 in the airframe and propeller industry, major ones in the engine industry. Among the leading airframe manufacturers we find some newcomers, like McDonnell, some disappearances, such as Brewster. Some companies, such as Vega, Vultee and Stearman, have become part of larger companies. But on the whole the planes of tomorrow will bear World War II manufacturers' names.

The jet engine, however, has brought two new and major producers into the engine field: General Electric, and Westinghouse. The fact that jet engines have never been mass produced in the sense that reciprocating engines were during World War II puts a great question mark behind all ratios shown below. For that matter, any bottlenecks anywhere down the line in airframes, engines, propellers, avionic equipment or armament may throw the paper calculations of any armchair mobilization planner out of the window.

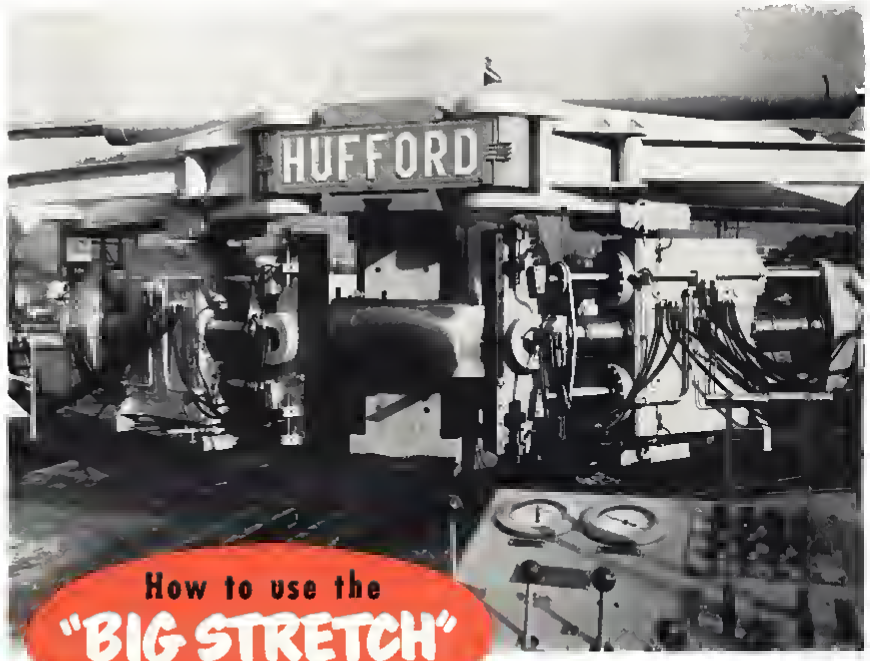
• **Floor Space.** Total floor space of airframe manufacturers in 1939 was only 7.5 million square feet, by 1940 it had grown to 9.5 million at the beginning of 1944 it was around 110.5 million; today it is probably 45 million, not counting the standby plants.

If we compare the floor space of airframe prime contractors in 1940, 1944 and today we find a ratio of 1 : 11.5 in 1944 and 1 : 4.7 today.

• **Employment.** Employment by airframe prime contractors climbed from 91,700 in 1940 to 804,600 in 1944. In 1950 it will probably average around 180,000. This gives us a ratio of 1 : 9.2. Such a ratio, however is badly distorted because of the strong effect of subcontracting in 1944.

A rough estimate, taking into account employment by prime contractors, subcontractors and parts suppliers of airframes, engines, propellers, gliders, and special purpose aircraft for June 1940, June 1944, and June 1950 produces a ratio 1 : 15.2.

* All data and ratios are based on data published by the government or AIA. Estimates are the author's. Data for "prime contractors" should be adjusted for subcontracting. While probably below 10 percent in 1940 and today, subcontracting during 1944 was in excess of 30 percent.



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Working together, these buyers and sellers of advertising have established standards for circulation values and a definition for paid circulation, just as there are standards of weight and measure for purchasing agents to use in selecting merchandise and equipment. In other words, A.B.C. is a bureau of standards for the advertising and publishing industry.

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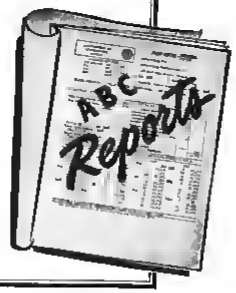
- A breakdown of subscribers by occupation or business.
- How many subscribers renewed.
- How many are in arrears.



McGRAW-HILL PUBLICATIONS

A.B.C. REPORTS — FACTS AS THE BASIC MEASURE OF ADVERTISING VALUE

• **Production.** Production of military aircraft presents a disappointing picture. In numbers, the ratio for 1940, 1944, and 1950 will probably be about 1:15.8.0.5, representing 6100 planes produced in 1940, 96,369 in 1944 and about 3000 in 1950.

More significant—and somewhat less discouraging—is the ratio for airframe weight (including spares) produced in the same years. Roughly, this ratio may be estimated on the basis of a 1940 production of 24.6 million pounds, a 1944 production of 1.1 billion pounds and an estimated 1950 production of more than 40 million pounds as 1.45:1.5/2.

The wide difference between the number and the weight ratio may be explained by the rapid increase in the weight of the average aircraft. This in turn is due to the shift from the production of the lighter trainers in 1940 towards the production of the heavier fighters and bombers in later years. It is also due to the constant increase in the average weight of each type of aircraft itself.

• **Pounds per Worker.** Pounds of military aircraft accepted per employe, adjusted for subcontracting and including the weight of spares, grew from 23 pounds in January, 1941, to a peak of 96 pounds in March, 1945. The 1944 average was 88.2 pounds per month. Today the output per man per month is probably below the 1941 figure. An estimated ratio of 1.4.5:1, for 1940, 1944 and 1950, would probably not be too wrong.

▶ **Plus & Minus**—The immediate availability of greatly increased facilities, both in use and in standby, appears to be the greatest advantage the industry has today over 1940. This is the direct outcome of wartime and postwar expenditures of about $4 billion by the government and by the industry which were invested in construction and equipment. These facilities, together with a reserve of machine tools, should allow a more rapid increase of production than was possible in World War II.

There are also more—and better trained—employes, plus a considerable number of workers with some wartime experience in aircraft plants.

On the negative side must be listed the fact that the industry may be called upon to accelerate its production at a time when manpower and materials may be increasingly difficult to obtain on a free market, and at a time when the draft and the call of the reserves seriously threatens its available manpower.

Another negative fact is that production has been allowed to drop to extremely low levels from which industry is only now emerging.

▶ **Government Preparedness**—The organizational confusion, conflicting authority, lack of program, unrealistic scheduling and material mismanagement of the early days of the last war are nightmares which still haunt manufacturers. Only practical experience will be able to tell if the government is better prepared today to cope with a new emergency more quickly.

The existence of the National Security Resources Board (and the fact that it finally has an aggressive head), of the Munitions Board, and of the Industrial Mobilization Planning bodies of the military departments give hope that this is the case. So does the fact that industrial mobilization contracts have provided tailor-made plans for the mobilization of major prime contractors.

On the negative side must be listed the hesitancy in facing necessary controls on the top levels of the government and the continuous lack of realistic scheduling of military aircraft procurement ever since the war. The latter seems to indicate a lack of comprehension or of application of many factors which the mobilization studies should have disclosed.

▶ **Industry Preparedness**—Organizationally, the aircraft industry is much better prepared today to cope with an emergency than it was in 1940. At that time the old Aeronautical Chamber of Commerce was limited in its representation of the industry and in its functions. In addition, the highly competitive situation of the industry made it unlikely that any cooperative venture would have much chance of success in the early days of the European war.

Actually, it was the Truman Committee which, by urging President Roosevelt to appoint an aircraft "czar," hastened the creation of the West Coast Aircraft War Production Council in April, 1942. Forgetting competitive practices for the duration of the war, members made available to each other, to the government, and to non-members all information which helped war production. The West Coast Council was followed by one on the East Coast and later by a national one.

In 1944, some of the functions of the Councils were transferred to the present Aircraft Industries Assn., and the Councils expired with the end of the war. The present committees of AIA would need only little expansion to assume the functions which AWPC carried out during the war.

In case of an emergency which would require all-out production once more, it will become a question of policy for the company presidents to decide if these activities should be carried out by the permanent trade association of the industry or should be transferred to an emergency body which could assume the quasi-governmental status which the AWPCs maintained during the war.

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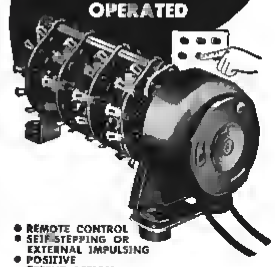

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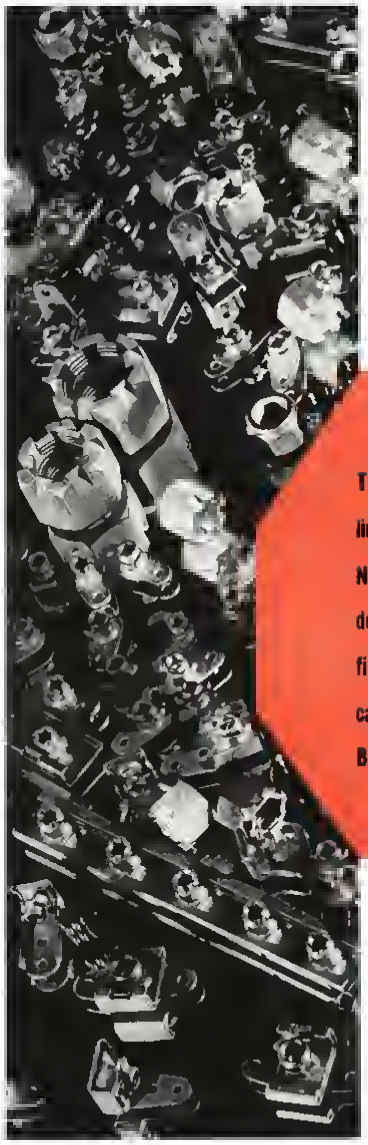

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Bids openings are 20 30 days after approximate issue dates shown in the following bid proposals Bid sets containing specifications for items to be procured will be sent to qualified applicants who state bid invitation number

One bid set will be available for examination without obligation by prospective bidders after bid publication date at each of the seven AMC procurement field offices This will enable firms to see specifications before writing or telegraphing for their own bid sets

Procurement field office locations Boston Army Base, Boston 10, Mass , Government Aircraft Plant No 4 Ft Worth 1, Tex 39 S LaSalle St , Chicago 3, Wright-Patterson AFB, Dayton, Ohio West Warren and Longo Aves, Detroit 32 155 W Washington Blvd., Los Angeles 67 Broad St N Y 4

INVITATIONS

Cock drains, 1-5 items bid invitation No 41-89 Issue date 31 July, delivery schedule shall be set forth in the call letters when issued

Knife compass unit, 1-8 items bid invitation No 41-86 Issue date 31 July delivery mil (listed) liquidated damages clause

Investees 1-4 items bid invitation No 41-94 Issue date 31 July, delivery complete within 120 days

Aircraft hardware 1-74 items bid invitation No 51-72 Issue date 31 July delivery schedule shall be set forth in the call letters when issued

Aircraft hardware class 04A, 1-86 items bid invitation No 41-81 Issue date 31 July delivery schedule shall be set forth in call letters when issued

Pins, 1-76 items, bid invitation No 51-73 Issue date 31 July delivery schedule shall be set forth in the call letters when issued

Aircraft hardware 1-17 items bid invitation No 41-60 Issue date 31 July delivery schedule shall be set forth in the call letters when issued

Drill press 1-2 items bid invitation No 51-79 Issue date 31 July delivery within 45 days

Aircraft hardware 1-70 items bid invitation No 41-92 Issue date 2 August delivery schedule shall be set forth in the call letters when issued

Office equipment 1-4 items bid invitation No 51 110 Issue date 3 Aug delivery 20% of all items 60 days after date of award balance 90 days after date of award

Aircraft harware, 1-42 items bid invitation No 51-103 Issue date 2 Aug., delivery schedule shall be set forth in the call letters when issued

Hardware, 1-59 items bid invitation No 41-99 Issue date 2 Aug., delivery schedule shall be set forth in the call letters when issued

Pins, 1-15 items bid invitation No 51-97 Issue date 2 Aug delivery schedule shall be set forth in the call letters when issued

Office equipment, 1-6 items, bid invitation No 51-112, Issue date 3 Aug delivery within 60 days

Personnel equipment, Class 13C 1-7 items bid invitation No. 51 111 Issue date 3 Aug delivery complete within 60 days

Aircraft hardware, 1-97 items bid invitation No 51-102 Issue date 3 Aug delivery schedule shall be set forth in the call letters when issued

Transformer rectifier, 1-7 items bid invitation No 41-113 Issue date 3 Aug., delivery complete by May 1951

Grinders, 90 each, bid invitation No 51-84, Issue date 31 July, delivery within 60 days after date of award

UP TO 15 WATTS POWER OUTPUT WITH THIS BENDIX-PACIFIC RELIABLE TELEMETERING COMBINATION

These two new units are indicative of the engineering leadership Bendix-Pacific has established in the field of electronics.

The new 421250 Transmitter supplements a complete line of telemetering components in the Bendix-Pacific FM/FM subminiature telemetering systems and has a nominal power output of 2 watts The total weight, including the case, is only 845 pounds and it measures 2" diameter by 5⅛" long

The 421250 Transmitter can be tuned over the frequency range of 215 mc to 230 mc and is adaptable for use with current fed or voltage fed antenna systems. It has a line of sight range of up to 40 miles and may be used to drive the 421230 Power Amplifier

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LETTERS

Milt Arnold on ILS

An article by Capt R. C Robson appearing in the June 12 issue of AVIATION WEEK entitled 'Need Improved ILS Monitoring' indicated serious deficiencies in the ILS monitoring system. The Air Navigation & Traffic Control division of the Air Transport Assn has actively followed the monitoring program. In view of the statements made in the article, it is considered desirable to clear up some erroneous impressions which may have resulted from reading this article.

The author states the need for two features to insure the reliability of the ILS, the first being fully automatic monitoring and the second the installation of a monitor at a point in the approach area which will check the localizer accuracy along the entire approach course.

With regard to the first point the CAA has under way a program designed to provide fully automatic monitoring of the localizer component. This program has met with considerable delay because of the contractors' inability to produce satisfactory equipment. All glide slope transmitters are monitored automatically at the present time.

The reference made in the article to airline crashes which occurred during ILS approaches, and the inference that these crashes were caused by failure of the monitoring system to indicate ILS malfunctioning, seem to us to be entirely unjustified. One might make a similar statement on the basis that all of the aircraft crashed because of flap failure because they were approaching with lowered flaps. There has been no evidence presented in any of these cases which specifically indicates ILS ground equipment malfunctioning or monitoring failure.

The suggestion made in the article to monitor the localizer at a point along the course is by no means a new idea. During the early stages of the development of the ILS, this idea was given serious consideration and tests were made to study its feasibility. With the introduction of the ILS into the European Theater of Operations in 1944, the idea was considered again and tests were made in an attempt to obtain satisfactory results of monitoring the localizer at the approach end of the runway. The results of these attempts to monitor localizers at the approach end of the runway have consistently resulted in failure.

The reason for this failure may be explained very simply. It is, of course, not feasible to place a monitor antenna at an elevation along the approach path comparable to that of an antenna on an aircraft flying an ILS approach. Practical considerations dictate that the antenna must be well below the full scale limit of the glide path in order not to present an obstruction.

Those familiar with the propagation characteristics of the VHF frequencies used in the ILS localizer are aware of the high degree of attenuation which occurs when a pick up antenna is lowered close to the ground. A monitor antenna, for instance, located at the middle marker at an elevation of 15 feet would receive a small fraction of the energy received by an aircraft antenna at an altitude of 200 feet above the ground. This low field strength results in a high degree of susceptibility to reflected signals. The ratio of reflected signals to direct signals received by the monitor antenna at the 15 foot elevation is very high and any aircraft or obstructions in the area will cause violent changes and variations in the course. For all practical purposes, it is impossible to obtain stable indications from a monitor situated at this location. Furthermore, the variations encountered here bear little relation to the variations encountered in the usable portion of the course.

The AVIATION WEEK article referring to swinging courses encountered at LaGuardia based on monitor recordings taken at the outer marker cannot be regarded as having any real significance. The present monitoring location which is about 150 feet from the transmitter represents the result of long experience in obtaining the most suitable location for accurately determining the stability of the course.

The bends which do occur in localizer systems are well understood and occur most generally from large obstructions such as hangars and power lines. They are most pronounced when these obstructions are located in close proximity to the transmitter. The closer the obstruction, the longer the period of bends. Practically all pilots are familiar with the instantaneous variation encountered during a localizer approach when another aircraft takes off directly over the localizer transmitter. This fluctuation remains for a period of approximately one to two seconds and although it is violent, it is well understood that it is not considered hazardous by most pilots.

We also disagree with the criticism of the use of GCA as a monitor for ILS. The two systems are by nature mutually complementary and when used together compound the safety of one another. The fact that in certain cases the ILS path has not agreed with the GCA path is a deficiency of a particular installation rather than of the concept involved. The use of GCA as a monitor has proved its worth on a number of occasions and is, in our opinion, an extremely valuable addition to the overall landing system.

We would like also to correct an impression given by the article on the effect of precipitation on radio frequencies. Serious attenuation due to precipitation effects does not begin to occur until frequencies of over 3000 mc/s are used.

It is not a particularly important factor even at these frequencies except in the case of primary radar where the amount of reflected energy picked up by the receiver is extremely small. Since the attenuation occurs in the space between the radiating antenna and the aircraft receiving the signal, insofar as ILS is concerned, the speed of the aircraft has no bearing on the amount of attenuation encountered.

It is likely that this impression may have resulted from faulty antenna fittings or some portion of the aircraft receiver input circuit which was affected by rain.

Although it is recognized that some precipitation and static is encountered with the frequencies used in ILS, the degree of this precipitation static at VHF is extremely small compared to that of an HF and LF. Precipitation static is rarely encountered for more than a few seconds on VHF while at lower frequencies entire trips are flown with serious interference from this cause. For all practical purposes, precipitation static at VHF can be neglected.

It is our opinion that the present program of the CAA for the improvement of monitor systems is generally sound and that much of the criticism contained in the AVIATION WEEK article was not justified.

MILTON W ARNOLD,
Vice President—Operations
& Engineering
Air Transport Association of America
Washington 6, D. C.

(Capt R. C Robson, author of the article discussed here, is an American Airlines pilot.—Ed.)

Free Enterprise?

First, I will introduce myself: Ex Army Air Force combat pilot, and presently Secretary of Viking Air Lines.

We nonskeds can't help but admire your past unbiased editorials on the "Air Coach" industry. You have continued to give the aviation public what the general public should have the opportunity to read.

Your editorial May 8, 1950, "Coaches Must Pay Off," says "The nonskeds were serving a new market." That is absolutely correct. It is now the market of the skeds. Through wise and future planning a few of the schedules have acted to capture the "Woolworth Market." Let's all give a big cheer to these able executives who can and will emerge from the beaten path and give us air travel at fares where we can all enjoy the speed available.

But what about the pioneers—the nonskeds that paved the way for the public to enjoy air coach?

Must they be throttled—put out of existence? Where is our free enterprise? I refer to the recent cease and desist order issued by CAB to Viking Air Lines.

Will someone please give me a sound and logical answer?

A. J. BAUGHMAN, Secretary
Viking Air Lines
Burbank, Calif.

Praise

We look forward to the receipt of AVIATION WEEK each week and depend almost entirely upon its contents to keep us informed of the happenings in the aircraft industry.

COWIN D DENNEY, President
American Helicopter Co., Inc
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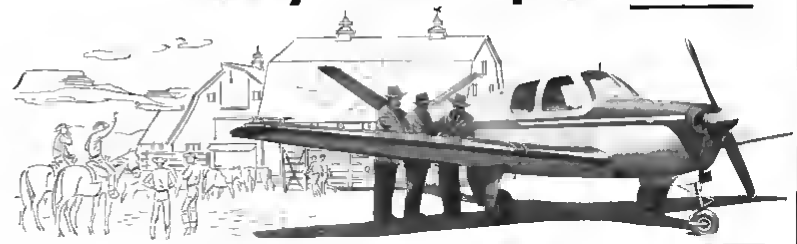
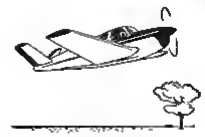
On the go? This Beechcraft lets you accomplish more!



Speed and Top Performance

Because you cruise at 170 mph, all the travel time you formerly wasted is put to *profitable* use. You measure trips in hours, not days. The Bonanza's 750-mile range gives you mobility of action.

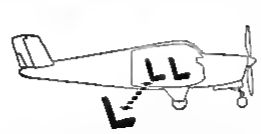


Short Field Performance

Take-off horsepower rating now 196 hp at 2450 rpm. New Beechcraft because of these features: propeller has greater static thrust. Action of retractable landing gear has been speeded up.

Solid In-Flight Comfort

Luxuriously appointed cabin carries four with plenty of "stretching room." Quiet soundproofed cabin lets you arrive ready for action. Luxury touches: arm rests, ash trays for all, three map pockets.



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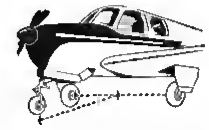
Want more cargo space? Rear seats are easily removable in 3 minutes. Regular luggage compartment accessible from inside or out. There's even a cabin coat hanger and room to carry clothes wrinkle-free.

"Passenger Car" Economy

Since the Bonanza uses only 56% of the engine's rated take-off horsepower, there's less engine strain, fewer overhauls. And upkeep is exceptionally low. You use only 9½ gallons of fuel per hour.



It's *Strong* as Safety

Sturdy, low cross-braced landing gear with its wide tread and long wheel base makes rough field landings easy. Rugged all steel frame far surpasses shock and stress requirement tests of CAA.

There's much more to tell about this versatile, economical business plane. For the full story on the revolutionary Model B35 Beechcraft Bonanza, contact your nearest Beechcraft distributor or dealer. Or for more details, write Beech Aircraft Corporation, Wichita, Kansas, U.S.A., on your company letterhead today.

Top speed, 184 mph
Cruising speed, 170 mph
Range, 750 miles
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Auto-Lite developed the 18A-1 for the most rigid requirements of civilian aircraft. This precision-made 18MM plug has butt type terminal, multiple electrodes, one-piece shell design, corundum insulator.

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C.A.A. approved for engines as specified

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Auto-Lite Spark Plugs—Patented U.S.A.

A request on your company letterhead will bring your copy of our special Aircraft Spark Plug Catalog packed with useful information such as latest C.A.A. and Engine Manufacturer's type specifications, service instructions and other vital facts.

SALES & SERVICE

Services Eye Aero Commander

Twin-engine executive plane versatile, maker says; would make good trainer; could take jet engines.

A versatile twin-engine prototype plane with a new CAA certification is making an all-out sales demonstration for potential Air Force and Army buyers at Washington National Airport.

Developed as 5-7 passenger executive transport of 4200 lb gross weight, the Aero Commander is now being merchandised to the military services as a "staff car" plane with twin engine safety.

But it has several other military possibilities, as well.

Theodore R. Smith, president of the company which developed it, Aero Design and Engineering Corp., Culver City, Calif., and former Douglas A-20 project engineer, cites some of its other potentialities:

• **The plane is described** as unusually easy to fly and suitable for training purposes yet with the "feel" of a larger twin-engine craft. It is known that a number of Air Force crewmen learned to fly "unofficially" starting out in C-47s and similar craft in World War II, without previous single-engine time. A twin-engine trainer such as the Aero Commander would enable the cadet to learn twin-engine flying practices from the beginning, it is claimed, without preliminary single engine time.

• **The Aero Commander,** stripped down, meets the 2500 lb weight empty limitation which has been set as the maximum for Army liaison and personnel transport planes, and hence would be eligible for purchase by the Ground Forces. However, with some Army and congressional leaders now advocating the establishment of a separate Army air force for troop support and supply outside the USAF, this 2500 lb. restriction may not be in effect much longer anyway.

• **Design possibility** for conversion of Aero Commander to jet power is intriguing. It could perhaps use the 770 thrust lb. J-55 engine developed by Fredric Flader Inc. or the Model 502 propeller turbine with 200 equivalent shaft hp. developed by Boeing. Smith reports that the plane has been stressed for higher power and speed than are currently used with its present power plants. It is envisioned by its designer as a good possibility for jet trainer use again with the important twin-engine safety feature.

• **The high wing,** tricycle-gear configuration of the plane makes it well suited for a small litter-carrying plane, and Smith has designs for interior conversion to carry three litters plus attendant and pilot. A folding door would open out of the top of the cabin to permit ready access to the litters for loading and unloading.

Among other uses for the plane are: light cargo carrier, air evacuation and air rescue, supply drop, wire laying, staff transport, gunnery or bombing trainer and target towing.

► **Specifications**—The all-metal Aero Commander has been generally described previously in AVIATION WEEK (July 11, 1949 and Nov. 28, 1949). Its most essential specifications and data are:

Alternate powerplants: Lycoming 190 hp. O-435-1 engines, now fitted; Lycoming GO 435-C engines (geared) rated at 260 hp. for takeoff, Continental E-225 engines, with normal-rated power of 225 hp.; or the jet and turboprop engines previously discussed.

Selected guaranteed performance data (with 190 hp. engines): maximum sea level speed 181 mph.; cruising speed at sea level at 75 percent power, 165 mph.; minimum control speed, 65 mph.; stalling speed flaps and gear down, 56 mph.; endurance at cruising speed with 105 gal. fuel, 5.25 hr.; rate of climb, first min. from sea level, standard atmosphere, 1440 ft./min., two-engine service ceiling, 22,100 ft.; usable ceiling, single engine with windmilling propeller, 5000 ft.; takeoff to clear 50 ft. obstacle, 1133 ft.; landing roll to stop after clearing 50 ft. obstacle, 1300 ft.; cruising speed at 10,000 ft., 179 mph.

While only one airplane has currently been completed, the engineering company now has substantial financial backing and is prepared to produce additional military and civilian models at Oklahoma City, Okla. It already has some components of additional planes and some tooling ready for use. Arrangements have been made to subcontract manufacture of some components to Luscombe Airplane Corp. and other manufacturers. Deliveries of production planes could be started by mid 1951, Smith states. Tentative price tag of $25,000 to $30,000 has been put on the airplane, depending on the quantity purchased, equipment installed and the particular model.

Engineering development of the plane was started by Smith and his West Coast engineering associates in 1945, but actual production did not begin until Aug. 1946, and the prototype made its first flight April 28, 1948.

The plane is certificated to meet stability, maneuverability and controllability requirements of Civil Air Regulation 03 in all flight conditions. Manufacturer states that from the date of the first flight until certification was completed (June 30, 1950) not a single basic change was made in the airplane.

Besides Washington demonstrations to Army, Air Force, Navy, CAB, CAA, Department of Agriculture, foreign air attaches, press, etc., the plane has gone recently to Fort Monroe and Fort Bragg for Army demonstrations and to Patuxent for a Navy demonstration. Following the Washington demonstrations it is expected to be shown to Air Materiel Command pilots at Wright Field.

THE NAVION 91760
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DEPOSITOR WITH WINGS

Four Indianapolis partner-owners of a Ryan Navion set up a bank account in the name of their plane to be used in paying operating expenses. Each partner pays seven dollars per flying hour, with overhaul costs determined in proportion to total hours each uses the plane. Extra equipment cost is divided equally. The check shown above is an old form; present ones bear the number of their 1950 plane, 51IK.

FINANCIAL

Mobilization's Effect on Airlines

Investors feel that all-out effort would mean peak domestic load factors and high plane utilization.

The expectation that any full scale mobilization of the nation's economy will follow the same pattern as in World War II is focusing increasing investor attention on the airlines

The air transport industry did very well in World War II from an earnings standpoint, despite (and because of) restrictions which were in force

The scheduled airlines are currently only partially committed, with 45 of their planes in charter operation for the military in the Pacific area

It is known that the air transport industry has evolved plans to supply additional aircraft to the military, on contract, should emergency needs demand it.

Final decision on the disposition of the commercial air fleets during an all out emergency rests with the National Security Resources Board, which is charged with coordinating and obtaining the maximum utilization of military, industrial and civilian facilities and manpower for war

The National Security Resources Board has not yet ruled on this determination Presumably this decision will be revealed when enabling legislation is sought to implement mobilization plans

►**Military Role**—It is logical to assume that, during wartime most U S international routes would be operated directly by the military or by the airlines under contract to the military On the domestic front the commercial carriers hope to preserve their identities as they did during the last war

The air carriers may fully expect the diversion of more of their four-engine aircraft to military operations as mobilization plans widen The full degree of such diversions will be influenced largely by the degree of emergency

In addition, there are about 650 twin-engine aircraft available among the scheduled airlines for domestic and territorial commercial use Many of these planes instead of having an average passenger capacity of 21, now have room for from 28 to 50 Greater speeds and faster turn arounds will also increase plane availability

►**Long-Haul Needs**—The commercial lines will seek to keep as many of their four-engine aircraft as they can for long-haul domestic routes There are practical operational problems if the airlines have only twin-engine equipment at their disposal

For example, a DC-6 or Constellation on an assumed long-haul with a 3 man crew is capable of producing 11,875 ton miles per day per man (averaging a 10-hour utilization), or delivering 15.2 ton miles per gallon of fuel consumed A twin-engine DC-3, under the same assumed conditions, could produce but 2100 ton miles per man (with a 2 man crew) and average only 4.7 ton miles per gallon of fuel

These comparative ratios merely highlight the heavy drain on manpower and fuel twin-engine commercial airlift would exert These requirements are prohibitive in time of national emergency and would almost automatically snarl the civilian airlift

Proponents of the commercial airline viewpoint assert that during wartime most of their traffic will be high priority passengers cargo and mail Moreover, it is essential to keep open the key lines of transportation and communication provided by the airlines if industrial production is to proceed at a maximum speed

►**Earnings in Emergency**—Airline earnings during a period of national emergency would be affected directly by the number and type of aircraft each carrier was permitted to operate

A clue to future earnings under mobilization conditions can be deduced from past experiences Of about 325 transport planes in domestic service on Dec 7 1941, almost half were requisitioned by the military Nevertheless, with but 51 percent of their former number of aircraft, the airlines were operating 71 percent of their former mileage

Despite the limitations imposed by the equipment shortages, the airlines continued to show increases in every revenue department during the four-year war period

A combination of circumstances was responsible for this unique showing In the first place, there was no problem of filling planes to capacity with passengers willing to put up with almost any sacrifice

The leverage factor came into active play—on the up side—under such conditions, and translated all revenues above the break even point to profit during World War II

Prewar load factors were considered satisfactory when ranging in the 70s With wartime traffic being maintained at capacity levels, load factors hit 90 percent and more The impact on earnings was obvious

►**Higher Utilization**—Greater utilization was obtained from each plane For instance, instead of flying less than seven hours daily, planes averaged closer to ten hours during the war years This permitted the carriers to fly an average of 1691 miles per plane per day during 1944, for example, with an average utilization of 10.49 hours daily

With depreciation and other fixed expenses continuing, whether planes flew or not, the importance of this higher utilization is quite evident The peak high utilization of airline equipment during the war years has remained unsurpassed thus far during the postwar years

For example, during 1949, the industry's daily aircraft utilization averaged 6.41 hours, resulting in an estimated 1100 miles per plane per day—the lowest utilization since 1941

►**Unknown Factors**—There are a number of unknowns, however, which can alter the airlines' optimistic outlook under full mobilization conditions. The industry will be subject to the same general tax imposts as apply to other businesses

Bland assumptions exist that the airlines will receive the same favorable treatment under any excess profits tax law as during the last war. At that time, the Internal Revenue Code provided, in substance that as long as an airline's adjusted net income did not exceed its gross mail pay, it was exempt from excess profits tax (Eastern was the only domestic airline which paid this tax during the war)

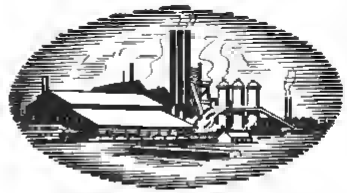
If the same provision were to be repeated in any subsequent excess profits tax measure the airlines, as a group, could earn more than three times their 1949 net profits before being subject to this special taxation

The ultimate course of inflationary pressures on airline operations must be given greater weight at this time than in the past

The present threat of increases in the form of wages and supplies can become very dangerous if the country's economy becomes involved in an inflationary spiral Unless the industry can adjust its relatively fixed rate structure to absorb any potential price increases it will be in a tight squeeze

The airlines, because of their peculiar leverage and attendant features, do not always follow the course of past patterns even when seemingly like conditions reappear Each phase of their development must be appraised in the light of changing circumstances

—Selig Altschul



1900 ★ THE MIRACLE OF AMERICA ★ 1950

Progress and Progress

It's no stretch of the imagination, rather, robust realism to call our past half century a Miracle—U.S.A.

America has set an amazing record of progress in 50 years—but a moment in the history of civilization. A record unequalled by any other political or economic system.

Merely by broad brush strokes, we can all visualize this miracle. Remember the crystal set, the hand-cranked car, the biplane? A far cry from our FM radio, television, hydro-matic drive and supersonic planes

And here's another phase of the miracle that went hand-in-hand with these and the myriad of intertwined technological advances—ranging from the radio telephone and Bakelite to the X-ray tube and teletype . . . and to atomic energy and its untold potentialities.

- ☆ Since 1900 we have increased our supply of machine power 4½ times
- ★ Since 1900 we have more than doubled the output each of us produces for every hour we work.
- ☆ Since 1900 we have increased our annual income from less than $2400 per household to about $4000 (in dollars of the same purchasing power), yet . . .
- ★ Since 1900 we have cut 18 hours from our average work week—equivalent to two present average workdays.

How did we do it? The basic cause for this composite miracle has been the release of human energy through FREEDOM, COMPETITION and OPPORTUNITY. And one of the most important results is the fact that more people are able to enjoy the products of this free energy than in any other system the world has ever known.

THIS IS THE MIRACLE OF AMERICA . . . it's only beginning to unfold.

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DC-6A illustrated Douglas ideas on commercial cargo plane design. Proven performance, high speed, very large aft door

Faster Planes Can Lower Cargo Rates

Douglas study shows how direct ton-mile cost is key to airfreight economy and suggests turboprop power.

Some well-accepted beliefs on commercial cargo plane design have been jolted by an engineer in a position to prove his words.

Warren T. Dickinson, assistant to the chief engineer of Douglas Aircraft Co.—the only manufacturer now flying a plane designed expressly for commercial cargo—the DC-6A—has carefully analyzed and thrown much doubt on two statements that have nearly become axioms among air cargo experts:

• **Cruising speed** should be about 300 mph. because cargo rates couldn't justify the cost of much greater speed. Not so, Dickinson implies. Greater speed to cut the flying time is important for a largely overlooked reason—it cuts down on the direct ton mile cost.

• **Cargo plane doors** should be at truck-bed height to save time and cost in loading and unloading. Not necessarily so, Dickinson says in effect. Truck-bed loading may cost more when, without it, an airplane can be more efficient and therefore more economical.

► **Turboprop for Cargo**—In a paper prepared for the California Air Freight Clinic scheduled last week at Berkeley, Calif., Dickinson, for what may be the first time, proposes a turboprop powered cargo plane to get the greater speed.

Douglas has studied such a project, he says, and concludes that a turboprop cargo plane will fly at least 50 mph. faster "and reduce the direct ton mile flying costs approximately 25 percent below those of presently available types."

That calculation, of course, assumes continuing progress in turboprop development, and Dickinson adds that it is not possible to say when a turboprop cargo plane can be built. But he doesn't doubt the practicality of such a plane.

"The high power and low engine weight of the turboprop power plant permits increasing not only the gross weight," he says, "but also the payload and the block speed, while increasing the cost per hour slightly due to the increased fuel consumption. The net result, however, is a substantial reduction in the costs per ton mile."

► **Important Costs**—Arguments about a cargo plane's speed have generally been based on the importance of the time in transit to the shipper. Considering the time advantage over surface transportation, and distance to be covered, and the cost of high speed, cargo students for some time have adopted 300 mph. as a good working figure for desirable cruise speed of a cargo plane. This was the speed recommended by the Civil Transport Aircraft Evaluation and Development Board, a government group studying transport plane needs.

Even a slow cargo plane greatly cuts the surface transit time, so Dickinson argues that shaving a few hours more off the transit time isn't the biggest advantage the shipper gets from fast cargo planes. The more important benefit—for both shipper and operator—is lower ton-mile direct operating costs. This also was stressed by another clinic speaker, D. A. Buck, of Boeing.

As Dickinson points out, airlines and government reckon all direct costs on a flight hour basis. He says "an examination of the actual flying costs of five representative airlines shows that approximately 75 percent of the direct flying costs are truly 'per hour' costs." So he set up this formula:

$$\text{Direct cost per ton mile} = \frac{\text{Direct airplane cost per hour}}{\text{Block speed} \times \text{Payload}}$$

As demonstrated by that equation, Dickinson says, "For a given payload, the lowest possible costs per ton mile will be achieved by the airplane having the highest block speeds and lowest air resistance. For this reason, aerodynamic cleanness is essential and will pay large dividends to manufacturer and operator."

► **Need for Efficiency**—"It is obvious that the future commercial cargo airplane cannot exhibit any truck-like characteristics in the air and still provide the lowest cost transportation. The extreme importance of economy in the cargo airplane demands the highest possible structural, aerodynamic and operational efficiency."

LARGE DOOR of DC-6A and hydraulic lift (left) simplify loading, and unobstructed hold will take cargo 52 ft. long (right).

It is just for such reasons of efficiency that Dickinson objects to the truck bed height philosophy. The average truck bed height, says Dickinson, is about 45 in. from the ground. To drop the fuselage that low requires a high-wing design for any airplane grossing more than 35,000 lb. (because of propeller clearance).

A high wing design immediately establishes two more requirements: a longer, and therefore heavier landing gear, a heavier fuselage structure to take loads supported by the wing in a low wing design.

That is no theoretical calculation. According to Dickinson, Douglas studied a high wing version of the DC-6A. Such a plane would have had an empty weight increase of more than 3000 lb. due entirely to the high wing design.

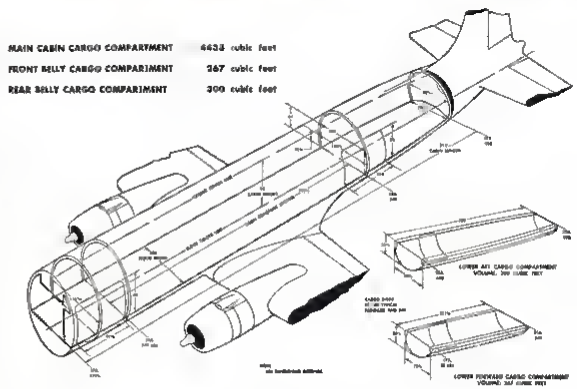
► **What Is Loading Cost?**—But it might still be possible that time saving in loading and unloading a high wing, low fuselage plane might overcome the weight difference. So Dickinson examines that phase, too. He says: "Several sources were questioned on the savings in loading costs possible on account of the reduced lift, and it was agreed that a figure of 10 percent appeared reasonable.

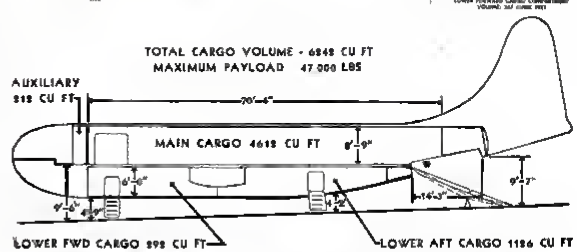
"Based on the actual average haul of 1425 miles (two airlines in May, 1950) and an average loading cost of $1.25 per ton, the saving will then amount to about $400 per month for an air freight operator doing 2 million ton miles of business a month.

"Since $400 is only approximately two-tenths of one percent of the direct flying costs for 2 million ton miles of work, it is clear that the basic flying costs are much more important than the loading costs."

Starting with a basic, proven airplane, with which most operators are familiar—the DC-6—Douglas designed a new fuselage to freight carrying requirements. It believes all loading conditions are adequately met by the DC-6A's very large (174x78 in.) rear cargo door and a forward door 91x67 in. Another method of adapting an existing passenger plane to cargo needs was explained to the Clinic by Buck, commercial representative of Boeing.

► **Boeing Approach**—The Boeing Stratofreighter can be used for commercial cargo, but the only planes of this type now flying are military C-97s. Considerably larger than the DC-6A (with a total cargo volume of 6848 cu. ft., as opposed to the DC-6A's 5000 cu. ft.),





TWO DESIGN philosophies on cargo planes are apparent in these sketches of the Douglas DC-6A (top), with only side loading, and Boeing Stratofighter (below), with various openings.

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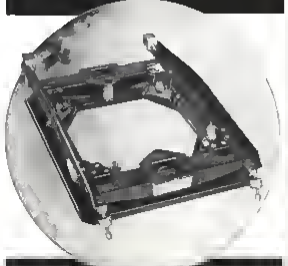
MOUNTING BASES



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  Equipment retains original positioning regardless of plane attitude . . . lose tipping . . . lose swaying
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- **REDUCED MOUNTING DRIFT**
  A secondary supporting system carries a portion of equipment weight thereby reducing stress on rubber mountings . . . no settling . . . no sagging . . . maintains original equipment positioning
- **DESIGNED FOR SAFETY**
  Mechanically interlocked metal parts prevent escape of equipment under abnormal conditions.
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Vibration-Control Mountings . . . Bonded-Rubber Parts

the C-97's two decks make possible a variety of loading methods. There is a ramp to the upper deck and that deck also has a built-in hoist to lift heavy cargo aboard. The lower deck may be loaded from trucks or with fork lifts, and loading can be undertaken at several points simultaneously.

In pointing up the importance of speed in cargo planes, Buck compared the Stratofreighter with "one of the standard airplanes now being utilized in the converted freight configuration" to show that while the Stratofreighter has much higher hourly costs, its greater speed "tends to produce a more even relationship for the per mile costs." And when you take into account the Boeing plane's greater payload, the Strato freighter's cost is only about 60 percent of the other plane's cost.

Perhaps the most effective statement of the importance of speed is Buck's simple "If the average block speed of the Stratofreighter were reduced 100 miles per hour, the cost per ton mile for the two airplanes would be equal"—despite the Stratofreighter's more than double payload.

Ethiopia Develops Air Services

(McGraw-Hill World News)

Addis Ababa—Landlocked, practically highwayless Ethiopia is doing its best to develop its air services and join together parts of the country which in the recent past were linked only by camel caravan traffic.

With the help of a U.S. loan, the Ethiopian Government launched in 1946 the Ethiopian Airlines Inc. This state-owned company connects the interior with Addis Ababa, and reaches several foreign capitals.

▶**Mainly C-47s**—Ethiopian Airlines today owns eight C-47s, five of which are used for passenger services, and three for freight. Two Convairs are on order in the U.S.

All the pilots, copilots and other flying personnel (except the stewardesses) are American. The stewardesses are mainly Greek, or Armenian. TWA manages the traffic.

The Ethiopian government plans to replace gradually all flying personnel by Ethiopians. Two years ago, it started an Imperial Air Cadet School at Bishoftu, near the Ethiopian capital, to train personnel.

▶**Cadet School**—The school's head is a Swedish airman, Colonel C. G. Von Rosen. There are about one hundred Ethiopian cadets, and thirty Swedish instructors. It is expected that the first full fledged native pilots will be through their course in about one year. Teaching is in English.

The school's fleet is made up of ten B-17s bought from SAAB with the help of a Swedish loan, (five more are on order) five Cessna training planes, and two small Swedish Saphyr trainers.

Lights For Weather

Pilots in the New York area will see new lighting effects on the Manhattan skyline beginning next month. The Mutual Life Bldg., just south of Central Park, will be topped by a "weather star" indicating local weather forecasts by means of colored lights.

Civil Aeronautics Administration approved the final color scheme and eliminated red lights which normally are used as obstruction markers. The weather star will indicate fair weather by a steady green light, cloudy by a steady orange light, rain by flashing orange, and snow by flashing white.

TAIL DRAGGING, BUT HEAD HIGH

This Martin 2-O-2 of Northwest Airlines gave a dramatic example of the value of the plane's wide C.G. range in this unorthodox landing at Minneapolis. The nose wheel jammed when the pilot prepared to land at Aberdeen, S. Dak., and the plane was turned back to Wold-Chamberlain Field at Minneapolis. Passengers and freight were moved aft and pilot Marvin A. Cooney landed the plane on the main wheels, skidding along on the tail with no serious damage to the aircraft and no passenger or crew injuries. The 2-O-2's C.G. range of from 13.5 to 38.5 percent MAC, due to the stabilizer's variable angle of incidence, simplified a landing that otherwise might have been impossible or very damaging under such emergency conditions.

TWA Drops Court Fight on Merger

Pan American Airways and TWA last week were busy with plans to serve their newly won European stops after TWA had lost its court petition for a review of the recently approved PAA-American Overseas merger.

The same day that the U. S. Second Circuit Court of Appeals in New York City said it had no power to review Presidential approval of the merger, TWA's Board Chairman Warren Lee Pierson signalized the end of his line's court fight with the statement "The Court has spoken. Now TWA intends to say it with service."

▶**Rival Plans**—Pierson pointed out that the decision adds London and Frankfurt to TWA's routes, which could now be served by "the largest standardized fleet of Connies in the world," and by the airline with "more postwar experience in continental Western Europe than any other U. S. airline."

Pan American countered by announcing plans to serve Rome and Paris, its two new stops, with its double deck Boeing Stratocruisers. It said it hoped to complete the merger with AOA in September.

But neither TWA nor PanAm could rush a mass of formalities that had to be gone through before the new services could start. CAB has yet to patch up parts of its merger decision, such as issuing its provisions for job protection of AOA flight personnel. The State Department and foreign governments have to iron out new traffic agreements. And the foreign route pattern has to be overhauled.

▶**Gains & Losses**—Now that it has all but accomplished the merger it set out to achieve about two and one half years ago, PanAm last week was toting up possible gains and losses. Its figures made President Truman's announced decision to increase competition look pretty good.

Based on data supplied CAB by the carriers concerned, PAA said that in 1948 (last year for which figures are available) about 52 percent of passengers traveling on U. S.-flag airlines to the major European stops went to points served by more than one U. S. carrier. For simplicity, call that competitive traffic.

In that year, about 48 percent was non-competitive traffic.

TWA's non-competitive traffic, PAA says, was about 30 percent of the 48 percent, PAA's nearly 9 percent, and AOA's 8 percent.

After the merger, PAA calculates that TWA's non-competitive traffic will be about 13 percent, with PAA's traffic of that type about 17 percent. And the

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***Specified* by Boeing Engineers for the Boeing B47**

Manufacturers like Boeing find Aerotec Pressure Switches built to exacting specifications for aircraft such as the B47 Stratojet, where performance qualifications are most demanding.

Now in production, Aerotec M-818 is vibration resistant up to 500 cps with 10 g's acceleration. It is capable of withstanding surge pressure of 120 psi, without change in setting. Rated for 28 volts DC, 3 amperes inductive, up to 45,000 feet.

All M800 series Aerotec switches are available for use with nitric acid, liquid oxygen, water, alcohol, octane and hydraulic fluids.

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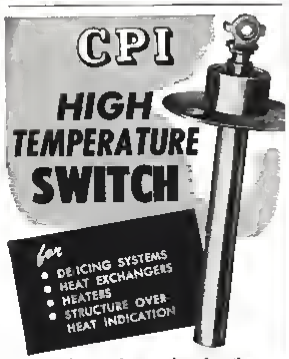

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competitive traffic—passengers on U. S.-flag carriers going to points served by both TWA and PAA—will go up from 1948's 52 percent to 69 percent.

▶ **Foreign Angle**—One of the motivating reasons all along for PanAm's desire to buy AOA has been the increasing competition from foreign-flag carriers. PAA felt that with one less carrier the other two would be in a stronger position to combat the foreign competition.

PAA used figures of the International Air Transport Assn. to assess the effect of the merger on the foreign-flag competitive situation. In 1946, foreign lines carried 16.7 percent of all trans-Atlantic traffic (both ways). By the first six months of this year, that figure had risen to 35.6.

Meanwhile, AOA's share of total Atlantic traffic had declined from 27.7 percent in 1946 to 19.1 percent in the first half of this year. PAA's share from 32.0 to 22.5, and TWA's share from 23.6 to 22.8.

Pan American Airways says that, assuming it and TWA now split 50-50 the London/Frankfurt and Paris/Rome traffic, the future should show PAA getting 33 percent of total trans-Atlantic traffic, TWA getting 31 percent, and the foreign lines still rising, to 36 percent.

Hearing Discusses Prototype Proposals

Congressional momentum gathered last week behind proposals for a full-scale government-financed prototype program to spur development of advanced transport types and build up national airlift capacity.

• **Three Senators** (McCarran, Lehman, Pepper) criticized as insufficient the proposed $12.5 million program under which Civil Aeronautics Administration would finance the testing cost of new cargo and transport planes. They said they would push for a larger program.

At first they threatened to block the testing measure, but later withdrew their opposition, and it was passed by the Senate.

• **Rep. Lindley Beckworth**, chairman of the transportation sub-committee of the House Interstate and Foreign Commerce Committee, told AVIATION WEEK that he would insist on "a program which will assure that our requirements in commercial aircraft are met—both as to types and numbers." Beckworth, the sponsor of a bill authorizing the expenditure of $50 million annually for aircraft research and development by the Navy, Air Force or CAA, has already stated his dissatisfaction with the testing program (AVIATION WEEK Aug. 14), now pending before his subcommittee.

• **Adm. DeWitt Ramsey**, president of Aircraft Industries Assn., conferred on the West Coast with aircraft manufacturers on an expanded prototype program.

Beckworth's subcommittee requested AIA to submit a proposal which would guarantee that the U. S. regain its lost position in commercial aviation. Ramsey testified that Great Britain now has a three-year lead in jet and turboprop types.

• **Secretary for Air Thomas Finletter** outlined USAF's requirements for air lift capacity to meet possible future emergencies at a closed door session of the Beckworth subcommittee.

Meanwhile, conflict over the prototype issue developed between the scheduled airlines and the independent carriers.

▶ **Lease Program**—Aircoach Transport Assn. and Independent Air Carriers Assn. called for a program directed primarily at increasing the commercial airlift capacity under which the government would buy planes and lease them to operators.

Air Transport Assn. supports an all-out effort to develop new types, but is firmly opposed to the leasing proposition. ATA claims it would amount to keeping an uneconomical government subsidized fleet in being, not justified by traffic.

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Aircoach opened its drive supporting proposed legislation which would set up a $250-million aircraft development corporation to promote development of new commercial types, purchase them, and lease them to qualified operators with testimony before the Beckworth subcommittee.

Speaking for the association, Amos Heacock opposed the testing program as "pre-Korean" and "special interest legislation" favoring the scheduled lines "already heavily over-subsidized and the luxury-type passenger, while neglecting air carrier expansion for national defense and the 90 percent of our voting public who cannot afford luxury type transportation."

Although the testing program provides for the testing of cargo and feeder aircraft, Heacock "inclined to view this as merely window dressing" for there is no evidence to show that there is any manufacturer in the U. S. who is prepared to design a cargo aircraft or a feeder aircraft because "... of getting free testing after the aircraft is designed and produced."

The testing legislation is "not a manufacturing bill at all," he continued, and would simply "enable the airlines to hang Allison turboprop engines on the Convair-Liner and on the Martin 4-0-4, possibly, and subsidize the cost of putting them into operation by paying for extended service testing along certificated routes."

Heacock told the committee that military cargo needs are 100 times the requirements of passenger transportation." The military would have no voice in the testing program, he objected, to direct it toward meeting this heavy demand for cargo airlift.

Airports Advisory Group Makes Report

Civil Aeronautics Administration's Airport Advisory Committee has made a number of recommendations on airport problems, policies, and practices now being studied by CAA.

The recommendations include: dissemination of information on proper use of bleed-off taxiways and warm-up pads, study of effects of turbojet engines, and proposed and existing braking devices on runway paving, an evaluation of aircraft activity with regard to payrolls, equipment, real estate, taxes and other tangible assets.

A study was suggested on revising the regulation on burning approach lights at certain airports between dusk and dawn even when no scheduled traffic exists, also reimbursements by non-aviation federal agencies to airport owners for use of airport space, assignment of responsibility by CAA management, and the airport user under bad-

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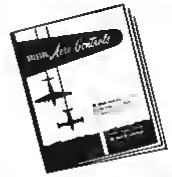

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The committee agreed with CAA's policy of disposal of intermediate fields, providing efforts are made to have public or private agencies maintain the fields.

43,000 lb.-Gross For TWA 2-0-2A

CAA last week certificated the Martin 2-0-2A twin-engine transports built for and leased to TWA, at a new heavier gross takeoff of 43,000 lb. This is the heaviest gross ever given a twin-engine transport, the manufacturer reports.

The new gross is 3100 lb. greater than the original 2-0-2 was granted and 1400 lb. greater than the guaranteed gross weight which Martin had specified to TWA when the leasing arrangement was made.

Completion of deliveries to TWA is scheduled in September, and the airline is expected to begin scheduled operations with the planes in the same month.

The planes are powered with Pratt & Whitney R-2800-CB-16 engines rated at 2400 hp. at takeoff and turning three-blade square-tipped Hamilton Standard dural propellers.

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SHORTLINES

► **Air France**—Probably will begin service to Montreal in the early autumn of this year, under the recent bilateral agreement between Canada and France for air service between Paris and Montreal. Air France has already opened an office in the new International Aviation Bldg. at Montreal in preparation for its new schedules. Meanwhile Trans-Canada Airlines, which has been designated to operate for Canada on this route, is studying the possibility of beginning operations some time ahead of the 1951 main summer traffic season.

► **All-American Airways**—Has completed reorganization of its traffic department, establishing a new assistant general traffic manager, and creating two new regional traffic managers for the northern and southern regions of All-American's seven-state route system, with 33 stations. Crawford W. Cline continues as general traffic manager, with Robert C. Meserve as assistant general traffic manager. James R. Williams and Ira B. Sperry are northern and southern regional managers, and Edward N. Page continues to head schedules and tariffs.

► **American Airlines**—Graduated 26 stewardesses in a Washington ceremony. C. R. Smith, American president, presented the silver wings to the graduates, who were then assigned to various base stations of the airline.

► **British Overseas Airways Corp.**—Reported U. S. dollar earnings from passenger sales for June in the U. S. and Canada were the biggest in history—topping $1 million, approximately twice the earnings for June, 1949. Eastbound traffic continued heavy from North America to the United Kingdom through July, with the number of passengers carried to Europe between July 1 and Aug. 5 about 70 percent greater than in the same period last year.

► **California Eastern Airways**—Completed its first trans-Pacific roundtrip under contract with the Air Force in less than four days and has expanded operations at its Oakland, Calif., base to meet added requirements of the airlift, including maintenance for aircraft of other airlift contractors.

► **Ellis Air Lines**—Certificated to operate in Alaska, has been directed by CAB to show cause why basic airmail rates of 50 cents a plane mile from April 1 to Sept. 30, and 80 cents a plane mile from Oct. 1 to March 31 should not be fixed as temporary rates.

► **Miami International Airport**—Continued expansion in international passenger and cargo traffic in the first six months of 1950. The airport handled international 266,701 passengers arriving or leaving from Jan. through June, 1950, compared to 235,146 during the same period in 1949. International mail amounted to 1,018,995 lb. and international cargo was 22,149,370 lb. in the first half of 1950, compared to 945,154 lb. of mail and 16,903,960 lb. of cargo in the corresponding period of the previous year. International passenger and cargo traffic through the Miami airport has more than doubled in the last three years.

► **National Airlines**—Credits its low-cost tours with a large part of the 84 percent increase in traffic between Miami and New York City for the three months ending July 31, as compared to the same period in 1949. More than 2000 of the low-cost tours have been sold, and the airline has received more than 60,000 inquiries about them. Latest of the tours announced is a Washington-Miami Labor Day weekend trip, which includes three days and two nights at a Miami Beach hotel, sight-seeing trip, and roundtrip air transportation for a package price of $103.44.

► **Northwest Airlines**—Has stepped up its training program for pilots, copilots, navigators and flight stewards to meet new demands for Pacific airlift crews. Trainees include 50 copilots, 30 navigators and 40 stewards. At peak employment now planned, Northwest will employ about 500 pilots and copilots, the largest number in the line's history. Trans World, Delta, Braniff and National are providing additional planes for the airlift as subcontractors to Northwest, which is providing three DC-4 planes of its own and all the crews.

► **Pan American World Airways**—Has designated Adm. John H. Towers, a veteran Navy airman, to direct its airlift operations to Korea, using a fleet of 27 four-engine planes, 10 from its own equipment and 17 from other international and domestic airlines.

► **Sabena**—Has occupied a new four-bay hangar at Brussels Melsbroeck airport, with each bay especially equipped for maintenance and overhaul of one of the four types of planes operated by them—DC-6, DC-4, Convair-Liner and DC-3.

► **Trans World Airlines**—Is continuing to replace DC-4s with Constellations on its international routes, and has just assigned a new Constellation to a direct U. S.-Israel weekly route. Two other Israel flights with DC-4s operate via Rome twice weekly.

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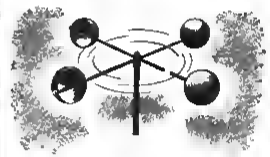

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▶ **United Air Lines**—Reported a 20 per cent increase in express and freight volume in the first half of 1950 as compared to same period last year. Volume has continued to rise in July despite the assignment of several United four-engine all-cargo planes to the Pacific airlift. Greater utilization of the cargo space on DC-6 passenger planes is expected to be a factor. Heretofore, many of the daylight DC-6 flights have been moving without their full cargo space utilized, because of a practice by shippers not to dispatch the bulk of their air cargo until after 6 pm.

▶ **Union of South Africa**—Has taken delivery on the last of four Lockheed Constellations ordered for the Springbok service. The planes and essential spares ordered cost the South African government approximately $6 million.

CAB SCHEDULE

Aug. 21—Conference on Board investigation on fares of New England Air Express Inc. (Docket 4558)

Aug. 21—Hearing on Southwest Airways renewal case. (Docket 3718 et al)

Aug. 23—Hearing on West Coast Airlines renewal case. (Docket 3966 et al)

Aug. 28—Hearing on control and relationships of Kessler Robin Airways, et al. (Docket 3943)

Aug. 28—Hearing on CAB's enforcement action against Air Transport Associates. (Docket 4266)

Sept. 11—Hearing on Lehman Brothers interlocking relationships case involving partners of firm holding airline directorships. (Docket 3665 et al)

Sept. 11—Hearing on enforcement proceeding involving interlocking relationships between Arrow Airways Inc. and California Arrow. (Docket 4267)

Sept. 11—Hearing on applications of Aerovias Q and Compania Cubana de Aviacion for Havana-Washington-New York foreign air carrier permits. (Dockets 3213 and 4187)

Sept. 18—Hearing on TWA and American Overseas Airlines requests to suspend service at Philadelphia on trans-Atlantic routes. Postponed from Aug. 7. (Docket 4228 et al)

Sept. 21—Prehearing conference on American Overseas Airlines' mail rate. (Docket 1660)

Sept. 25—Hearing on Board investigation of all-expense fares of Eastern Air Lines et al. (Docket 4443 et al)

Sept. 26—Hearings on Mid-Continent Airlines application to have its Route 89 certificate (Tulsa-Houston) made permanent. (Docket 3692)

Oct. 2—Hearing on renewal of Frontier Airlines' feeder certificate and service suspension at two United Air Lines stops in the area. (Docket 4348)

Oct. 8—Hearing in Latin American Airfreight case. (Docket 2583 et al)

Oct. 18—Hearings on Los Angeles Airways' application for renewal of its helicopter mail-cargo certificate and for additional authority to carry passengers. (Docket 3808)

Dec. 11—Hearing on Board investigation of West Coast passenger fare structure. (Docket 4586)

Jan. 8, 1951—Hearing in Big Four mail rate case and CAB investigation of the carriers' economy and efficiency. (Docket 2548 et al)

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GOVT. C. A. A. and VETERANS APPROVED
ENROLL NOW FOR NEXT CLASS
Write for Illustrated Catalog
2206-16 E. HUNTINGTON ST., PHILA., PA.

LOCKHEED LODESTAR
—only 1450 total hours on airframe—
complete in its equipment, beautiful plush executive interior, recent major overhaul on airframe by Lockheed factory, an exceptional plane.
PAGE AIRWAYS, INC.
ROCHESTER AIRPORT ROCHESTER, N. Y.

FOR SALE
1—Type A-1-RR ONSRUD HIGH SPEED RADICAL ARM ROUTER Motor Driven New 1942
1—#73 Heald Grinder, AC Motors.
VICTOR MACHINERY COMPANY
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STRICTLY PERSONAL

SOCIETY DEPT. (WEDDINGS)—His friends in aviation will be interested to know that **Blaine Stubblefield** has gotton himself married. For years, Blaine was attached to McGraw-Hill's Washington Bureau. He wrote for Aviation, Aviation News and Business Week. Besides being a top-noteh writer, Blaine is a Character. He was a pioneer flyer right out of the rugged West. He's still rugged, as our latest news indicates. Blaine used to go free wheeling down the Connecticut Ave. hill in the morning rush hour traffic on a sleek, shiny, black English bike with his gray hair ends flying from under his snappy French beret. He got to the National Press Bldg. in something like half the time it took other more conventional commuters. He chained his steed all day to a water pipe or something in front of a snazzy ladies' shop in the Willard Hotel building and we always wondered what he had on the manager to wangle that. Blaine knew billbilly songs galore, but the best were the lusty ones he composed himself and recited to the accompaniment of his trusty gee-tar. He made jillions of folk song records for the Library of Congress, and he had a regular spot on a local radio station which finally gave up hope of getting a sponsor for him. Blaine and his bride, the former Verna Alice Hennig, were married at Boise, Ida. by a Judge R. W. Adams, a colorful pioneer of the mountain region. Blaine has just completed a special power boat and has run the first daring excursion through Hell's Canyon of the Snake River between Weiser and Lewiston, Ida. Hell's Canyon, deepest in North America, has never been accessible except to the hardiest adventurers and the project has aroused rapt attention among adventurers and westerners. What a way to make a living! (There's a long feature article about Blaine's first dash down the rapids that appears in the June issue of U. S. Air Services magazine.)

* * *

Phenomenon

In the heavens no! But thanks to my wife
On occasions when I cross her
I have observed, large as life
More than one flying saucer!

Thomas Usk in the N. Y. Herald Tribune

* * *

LEAR AND THE STRENUOUS LIFE—Norm Warren of Lear, Inc., California Div., asks if we have ever flown with strenuous Bill Lear, the company's effervescent board chairman. It's apt to be exhausting. Watching him work wears you out. A high Air Force officer recently flying with Bill as a guest from Los Angeles to Grand Rapids got the full treatment. Immediately after takeoff, Bill turned on the Lear Autopilot, then went aft with a screw driver to make some experimental adjustments. Then he proceeded mysteriously to change electronic tubes for the next half hour. Then he set up his desk in the cabin and scribbled electrical circuits by the dozen. Then he got out his squawk-sheet and wrote up a page full of items that would keep his maintenance crews at Grand Rapids working through the night. Then he checked the alignment of all the ILS facilities along his route. Then he wriggled his ample frame into the narrow tail section of the Beech to change an inverter. After a few hours watching this performance, the frazzled brass turned to another passenger and said, "He's not flying this plane—He's building it."

* * *

NOTICE TO B-36 OPERATORS—Several of you readers were amused or puzzled at that classified ad in Aviation Week's June 5 issue addressed to "B-36 Operators, Attention." We wrote Standard Aircraft Supply Co. at Oklahoma City for an exclusive story for this column. We wanted to know if they really meant B-26 and were going to make our ad department correct the error and run the announcement again free.

Nope. Sam A. Crites, sales manager, says they are "very pleased" with the reaction. They got more mail than our letter. One sounded like trouble. It was from the director of patents for Convair at Ft. Worth, pointing out that the B-36 is a very highly classified aircraft and that there were no operators of B-36s except the USAF. He hinted at dire consequences. But Mr. Crites consulted Tinker Air Force Base at Oklahoma City and they told him that classified aircraft or parts disposed of as surplus or obsolete were automatically declassified or mutilated, so the ultimate owner could do anything he wanted.

Says Mr. Crites: "In any event, the class of B-36 material we have been purchasing is generally airframe parts such as air scoops, ducts, walkways, contravanes, diffusers, panels, engine mounts, etc. These items were bought to very large quantity and are in prime condition, except that they are obsolete."

"Being aware of the impact of directing advertising to B-36 operators, we thought it would be a novel manner in which to stop the eye of your readers. Needless to say, this has been accomplished. We feel that our small initial investment in placing this ad has paid multiple dividends." Smart salesman, that Mr. Crites.

—R.H.W.

WHAT'S NEW

New Books

New cross-country navigation systems being put into effect will leave the average pilot "as far behind aviation progress as the triplane" unless he bones up on the changing trend. **Flying the Omnirange**, by Charles A. Zweng, is a pilot's guide to VHF omnirange, distance measuring equipment, and the course line computer. Written primarily for the average pilot rather than the technician, it is a practical text on the use of new radio navigation facilities now being installed across the U. S.

There is a non-technical discussion of VHF radio waves, how the omnirange transmitter and receiver function, and how omnirange is actually used to guide aircraft to or away from a station merely by indications of a "left-right" needle, without regard for wind drift.

"Flying the Omnirange" also contains the detailed report of a 500-mi. cross-country flight by means of VOR, and a review of all currently available omnirange receiving equipment.

In addition, the book contains 77 study questions with answers, a glossary, and a folding map of all U. S. omnirange stations, both in operation and planned.

Published by Pan American Navigation Service, North Hollywood, Calif., and the Weems System of Navigation, Annapolis, Md., the book is 101 pages and sells for $4.00.

New Addresses

Flight Safety Foundation has moved its offices to 2 E. 64 St., New York City 21. The new phone number is REgent 7-8100.

Tinnerman Products, Inc., has a new mailing address: P.O. Box 6688, Cleveland 1, Ohio.

Frank R. Brune, advertising agency for the Babb Co., has moved from 1227 Avenue of the Americas to larger quarters at 270 Park Ave., New York. The new offices are on the twelfth floor, wing D.

William Crosby & Sons, manufacturer's representatives in Lima, Peru, desire contacts with U. S. aircraft and equipment manufacturers seeking sales representation in Peru. The concern has been established there since 1918. Address is Post Office Box 2326, Lima.

Telling the Market

Booklet describing Nukem Products Corp. Nukemite synthetic acid- and alkali-resistant coating should interest airlines maintenance personnel. Write the company at Buffalo 20, N. Y.

ADVERTISERS IN THIS ISSUE

AVIATION WEEK—AUGUST 21, 1950

■

PROFESSIONAL SERVICES—
First issue of each month

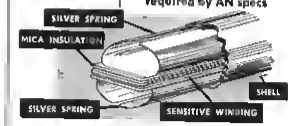
■

SEARCHLIGHT SECTION
(Classified Advertising)

When you need AN-5525 Thermometer Bulbs remember these EDISON Features

Edison Thermometer Bulbs

- provide faster response
- permit higher operating temperatures than required by AN specs



Patented silver sprung design permits faster heat transmission to sensitive windings provides excellent cushioning against shock

Available in standard AN-5525-1, -2 and USAF reinforced type G-1, as well as new dual-element type 174N90D that provides temperature indication at two separate panel instruments from a single bulb. Both G-1 (reinforced carb air) and D-1 (heater duct) bulbs permit operating temperatures as high as 600° F. Write for literature.

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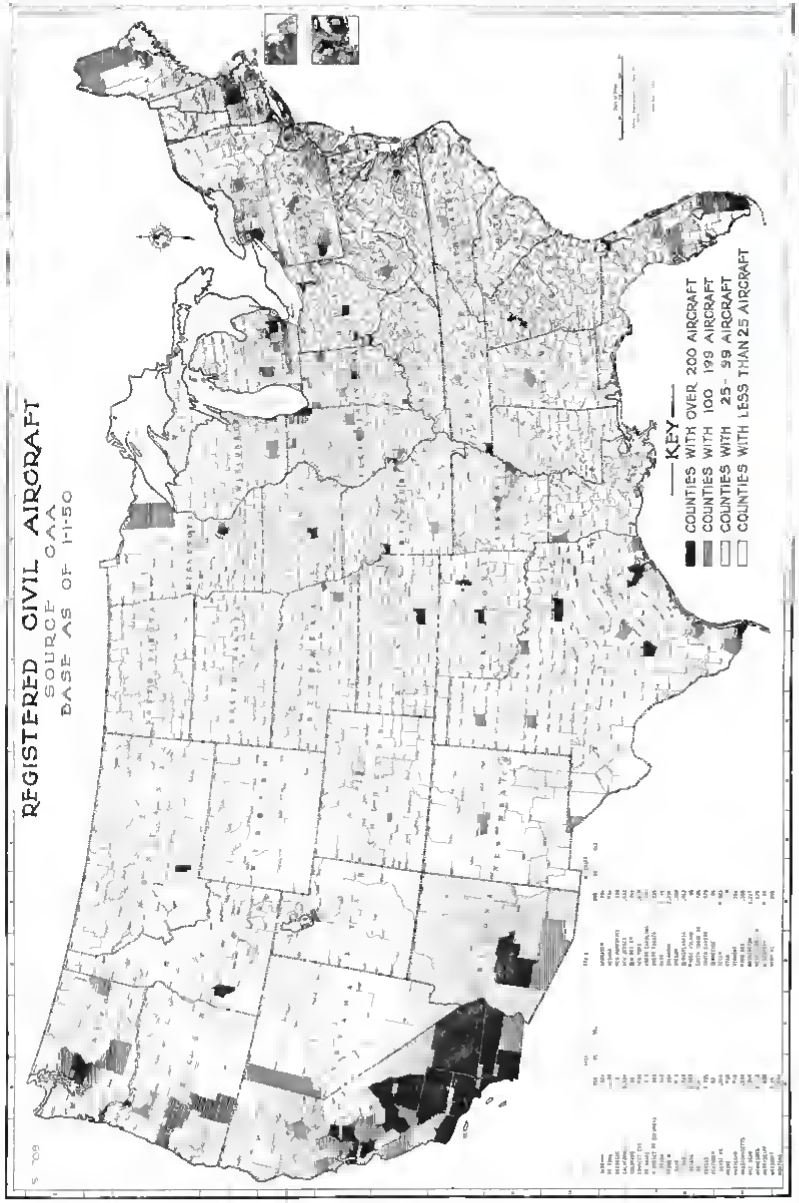
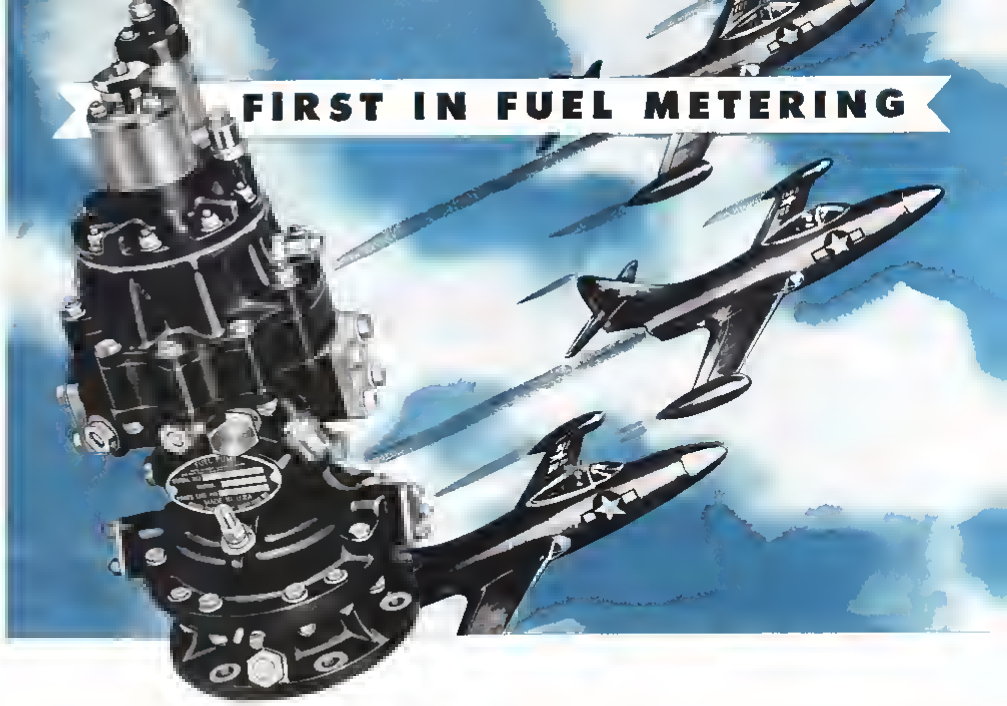


(Prepared for Goodyear Aviation Products division distributor sales department, Akron, O., by American Map Co.)



***Precision* Is the Keynote—in Production and Performance!**

The word *precision* perfectly characterizes practically every piece of fuel metering equipment manufactured by the Bendix Products Division. It starts with the business-like efficiency in which the many planning and manufacturing operations are carried out, but, this precision is most apparent in the *performance* of the finished product. The Bendix JP-A3 fuel supply pump is typical: compact, light in weight, it nevertheless delivers up to 900 gallons of fuel (gasoline included) per hour, per unit. Its advantages include a variable pump output, an ability to work under high pressures (up to 1300 lbs. psi) and yet it needs no lubrication. Whatever your requirements, be sure to get *precisely* what you want from Bendix Products Division.

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On the landing geor and in the wings of this dauble-decked air giant are actuators and pawer units manufactured by Faote Bras. In the mighty Pratt & Whitney engines that pawer this plane ore gears produced by Faate Bras. Taday equipment fram Faate Bras. is serving an mony af Americo's madern air liners ond air freighters—on bombers and tronsparts—on jet fighters and helicapters.

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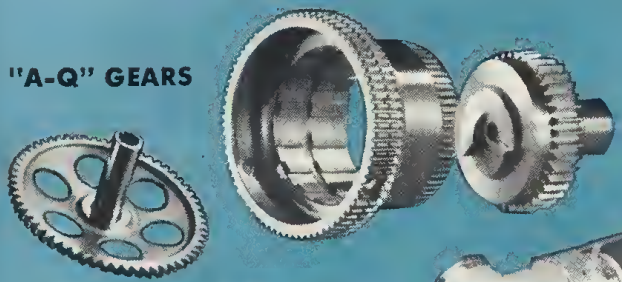
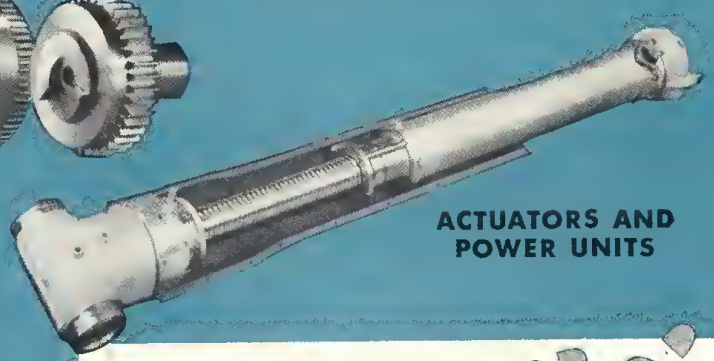
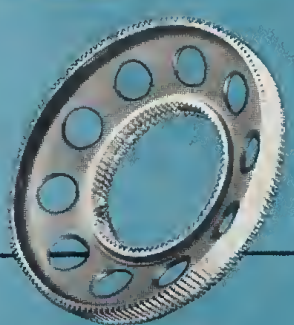
"A-Q" GEARS





ACTUATORS AND POWER UNITS



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Better Power Transmission Through Better Gears